

# Promoting a Lead-Free Community

## An Educational Program for Schools in Thailand

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## An Educational Program for Schools in Thailand

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## Abstract

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Students in Thailand are susceptible to numerous health problems due to lead exposure in schools and the environment. To address this issue, an educational program was designed to inform elementary school students, teachers, and administrators about the sources, effects, and methods of prevention and mitigation of lead exposure. A literature review and interviews with teachers were used during the design phase of the program. Input from teachers was utilized to create a comprehensive package of educational materials, including two lesson plans, pamphlets, posters, stickers and instructional videos. All materials were made accessible on a website for school faculties, families, and the general public. This program was first tested at an elementary school in Bangkok, Thailand. Frameworks for risk communication and participatory action research were utilized to continuously improve the lesson's success. The program underwent a second test at an elementary school in Rayong, Thailand at which there were measured elevated levels of lead in children. The results of these trials lead to multiple final revisions and a complete final program. Evaluations have revealed that the program is effective. The School of Global Studies at Thammasat University sponsored the design, creation, and testing of this educational program and we recommend that they encourage implementation at every elementary school in Thailand.

# Executive Summary

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## Background

Lead is a chemical that is present in the environment that can be dangerous in high concentrations, especially to children. Industrial processes may introduce lead into the nearby environment's air, water and soil. Another common source of lead in the United States and Thailand is lead-based paint, which can often be found on walls, playgrounds and toys. When lead paint is scraped, dust particles may be released into the air and soil.

From a source in the environment, lead may enter the body through different pathways. This may occur through inhalation, ingestion and breaks in the skin. Due to the fact that lead is odorless and tasteless, contact may occur without an affected person's knowledge. Symptoms of acute exposure include irritation of skin, headache, nausea, vomiting, and fatigue. Young children and fetuses are most susceptible to the effects of lead exposure because they are still in the developmental stage.

The ideal way to protect children from unhealthy lead exposure is to remove the source from the environment. However, this may be difficult to do and often expensive. Thus, the next option is to reduce exposure by practicing healthy habits. Many times, young children need to be taught these behaviors, which include frequent hand washing, avoiding foods with artificial dyes, among others.

## Goals, Objectives, and Methods

**The goal of this project was to reduce the instances and harmful effects of lead exposure for students, families, and teachers in Thailand by informing them about the sources, effects, and prevention methods related to lead exposure.** In order to do this, our team focused on developing and testing an interactive and informative educational program for use in schools across Thailand. We created four objectives based on a ten-question guideline for developing risk communication programs from the Center for Environmental Communication at

Rutgers University in the United States. The guideline asks questions like “Why are we communicating? Who is our audience? What do we want to get across?” all the way to “What problems or barriers have we planned for? Have we succeeded?” The guideline was also a good model for participatory action research, which ensured that the school community was involved in the development of our program. This involvement created a sense of ownership, which resulted in a more successful and sustainable program.

To attain the project goal, we accomplished four objectives:

1. Gained an understanding of how to most effectively educate school communities in Thailand,
2. Designed an educational program to inform students, families, and teachers about lead exposure,
3. Implemented the educational program in two schools; one in Bangkok and one in Rayong, and
4. Evaluated the effectiveness of the entire program to ensure that the project goals were accomplished and adjusted the program as necessary.

We used these objectives in the process of our methodology. The process of iteratively designing, implementing, and evaluating our program was performed twice—once in Bangkok, and again in Rayong. This ensured that we constantly evaluated our results and created the most effective product. This process is shown in Figure 1.

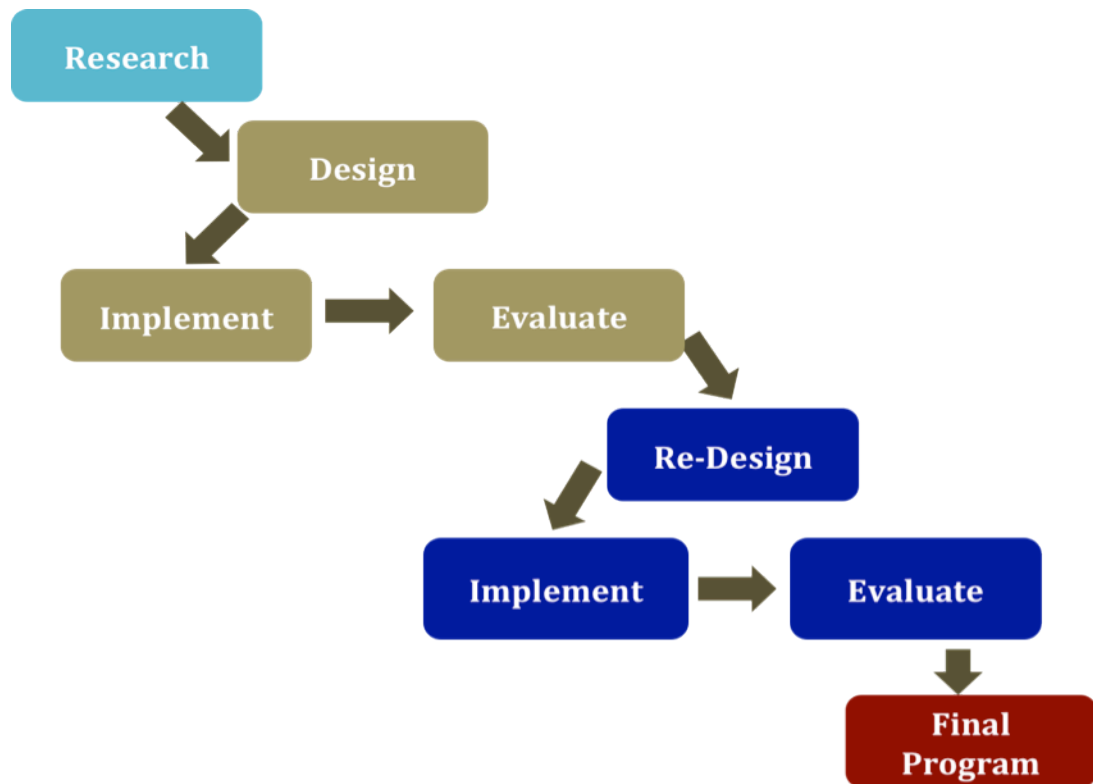


Figure 1: Methodology: Two cycles of Objectives

In Figure 1, the sky blue box represents our first objective. The tan boxes represent Objectives 2-4 in Bangkok, and the dark blue are the same objectives performed again in Rayong. Finally, the red box represents the revisions of our final deliverables and recommendations.

*Objective 1: Determine how to most effectively educate the community.*

Our first objective was to determine the strategies that would allow us to best educate our target audience. The groups of students that we focused on were in grades 1-6. Previous examples of programs, information from our literature review, interviews, and meetings with school faculty provided us with a foundation of how to effectively educate the community.

*Objective 2: Design Educational Program*

The second objective was to design the educational program about lead exposure. The design of the program was based upon the information gained from

Objective 1. Several target groups were established in order to accommodate each audience. These groups consisted of younger elementary students (grades 1-3), older elementary students (grades 4-6), school administration, teachers, and parents of students. Dividing the community in this way allowed for specific deliverables addressing the needs of people in different developmental stages and occupations.

The educational materials we created for the students are similar in that they both include an informative lesson followed by a quiz game. Lesson plans detailing the program for each age group were created so that any teacher may facilitate the lesson. Two superheroes, Lead Boy and Lead Girl, are an omnipresent part of the educational program. They appear throughout the material as a creative way for people to remember the information provided. An informative video featuring these two superheroes provides the younger students with an entertaining lecture. A traditional Thai game called Soi Dao (“lucky star”) quizzes the students’ comprehension. The older age group’s material consists of an interactive lecture followed by a Jeopardy style game to test knowledge.

Additional deliverables created to further promote the message and to inform more members of the school community include posters and stickers. These serve as a visual reminder for students and faculty to practice healthy habits. Informational pamphlets distributed to school administrators and teachers to be sent home to parents. These pamphlets provide information about the possible sources of lead exposure, means of prevention and mitigation. All of these deliverables are located on “Lead Free Community,” the Thai-language website that was created. This package of program materials aimed to be both informative, as well as sustainable. With a set lesson plan of instructions and teaching aids, we created an easily repeatable program to help current and future students.

### *Objective 3: Implement Educational Program*

This program was implemented and tested at two elementary schools in Thailand, as shown in Figure 1. The first school was Wat Pathumwanaram School under the Royal Patronage of H.R.H. Princess Maha Chakri Sirindhorn in Bangkok.

Grades 1-5 participated in the lesson and this school served as a test site to determine program effectiveness. The second school, Baan Khao Huay Mahad, was located in Rayong, a southeastern province of Thailand. This school experienced controversy regarding lead exposure. To combat this, testing in Bangkok ensured that the program presented in Rayong was a strong prototype. In Rayong, a 3<sup>rd</sup> and a 5<sup>th</sup> grade class participated in the program. This was a successful implementation, and the students learned more about lead than in the first phase. Although testing only occurred at two sites, implementation could have continued in as many schools as desired in order to develop a best final product.

#### *Objective 4: Evaluate Program Effectiveness to Ensure Best Methods*

Data were gathered both times the program was implemented. These data included student survey results, feedback from teachers, and in-class observations. Students and teachers were surveyed after the lesson as an educational tool and method of data collection. The feedback and comments from the teachers' post-program survey provided valuable information. This information was analyzed for topics such as student knowledge gain, teacher satisfaction and program effectiveness. These evaluations provided a basis for re-design by highlighting areas that needed improvement. The evaluation process was completed two times and led to the completion of a final set of deliverables. The deliverables created are an all-encompassing set of materials that may be applied to any elementary school in Thailand. The materials in our educational program were uploaded onto our program's official website, so it is easily accessible to schools across Thailand.

#### **Findings**

Evaluations of results from the two schools lead to a series of findings. First, it was determined that **games, participation and rewards serve as the most effective methods of student education**. Background research was conducted on this topic by studying existing programs as well as general student education. Teacher interviews also provided valuable insight as to how their students learn best.



Second, **lack of knowledge about lead exposure is associated with a lower willingness of teachers to educate their students about lead.** The implementation at two different schools reflected this finding clearly. Wat Pathumwanaram School in Bangkok did not have any record of lead exposure. Because of this, the reluctance of teachers in Bangkok school was striking. They did not see lead exposure as a current issue to be concerned with in their school. On the other hand, recent studies at the Baan Khao Huay Mahad School in Rayong have identified children with high blood lead levels. Even though the students and teachers themselves already had some basic knowledge about lead exposure, administrators and the teachers were more willing to implement our educational program in order to better inform their students.

Third, **most students who participated in our program already had substantial knowledge of the negative effects of lead but lacked awareness about lead sources and exposure prevention methods.** They knew that lead could make them sick, however their awareness about more specific issues was much less.

Fourth, **students at schools with known lead issues had greater pre-existing knowledge of lead sources and exposure prevention methods than students at schools without lead problems.** At Baan Khao Huay Mahad, a doctor had already visited and given a presentation to the students about lead exposure and its prevention. In contrast, Wat Pathumwanaram School had no special session about lead exposure prior to our visit.

Fifth, we also found that **our program effectively educated students about the sources of lead.** After the implementation with the short story, presentation, and games, almost all of the students from both schools could recognize sources of lead. Some major sources include: the paint in playgrounds and toys, air and dirt, and the coloring agents in food. These findings were based on the pre-survey and post-survey results. This improvement demonstrates the effectiveness of our program.

Sixth, **this program effectively educated students about lead exposure prevention methods.** Once the students knew the sources of lead, the next step

was to learn how to protect themselves. The methods of prevention taught included washing hands, drinking milk, no toys in the mouth, and maintaining a good diet containing calcium, vitamin C, and iron. According to the pre-survey and post-survey results, the percentage of the students who could recognize the methods to prevent themselves from lead increased. This indicates that the students participated and paid attention to the story and presentation during the implementation.

Seventh, **the students felt empowered and able protect themselves after our program.** By mentioning the health effects that lead exposure may cause, the students felt that they should be protecting themselves in order to not experience the severe health damages. There was one question in the post-survey for Baan Khao Huay Mahad School asking the students if they now know how to protect themselves from lead and all students answered yes.

Eighth, **our program was enjoyable and informative, and the students had fun participating in our lessons.** Based on observations, pre-and post-survey results, and teacher feedback after the program indicated that students participated in the activities enthusiastically with games and prizes. They focused and learned during the lessons with positive attitudes.

## Recommendations

Based on the findings and researched background information, we created a list of final recommendations for our sponsor, The School of Global Studies at Thammasat University, the Ministry of Public Health in Thailand, and future researchers. We strongly recommend that:

1. An educational program to inform school communities about the sources and dangers of lead exposure and how to prevent or mitigate its impacts be implemented throughout Thailand.
2. The School of Global Studies send information about our educational program to every school in Rayong, Thailand. Success in Rayong would result in a recommendation to send information about our educational program to every school in Thailand.

3. The Ministry of Public Health in Thailand provide more information to the public about paint containing lead, lead exposure on toys and playgrounds, and resources for lead paint removal.
4. The School of Global Studies offer information to administrators, parents, and donors of school communities across Thailand about safe donation practices.
5. Future researchers continuing our program design and create a Survey Result Database to track the implementation and success of our program in the future.
6. The Ministry of Public Health in Thailand hosts our original website, Lead Free Community, improves its content, and makes the information and educational program more accessible to schools and the public.

## Conclusion

This project has the potential to touch every school in Thailand. The final deliverables created provide helpful information to students, parents, teachers, and school administrators to ensure that they can protect themselves from lead exposure and its effects. In showing school communities about the dangers of lead, we chose to empower the students, not scare them. Although continual lead exposure may be detrimental to one's health, there are steps that may be taken in daily life to minimize exposure. By recognizing sources and practicing healthy habits, it is possible to remain safe from lead exposure. This program educates and informs the target audiences about these issues and practices. Because of this, school communities in Thailand are empowered to stay healthy and inspired to take steps towards living in a lead-free community.

## Acknowledgements

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# Table of Contents

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Abstract.....	i
Executive Summary.....	ii
Background.....	ii
Goals, Objectives, and Methods.....	ii
<i>Objective 1: Determine how to most effectively educate the community</i> .....	iv
<i>Objective 2: Design Educational Program</i> .....	iv
<i>Objective 3: Implement Educational Program</i> .....	v
<i>Objective 4: Evaluate Program Effectiveness to Ensure Best Methods</i> .....	vi
Findings.....	vi
Recommendations.....	viii
Conclusion.....	ix
Acknowledgements.....	x
Table of Contents.....	xi
Table of Figures.....	xiii
List of Tables.....	xiv
Chapter 1: Introduction.....	1
Chapter 2: Background.....	3
2.1: <i>Lead Today</i> .....	3
2.1.1: <i>Consequences of Lead Pollution in Thailand</i> .....	4
2.2: <i>Chemical Information</i> .....	4
2.3: <i>Sources of Lead and Pathways of Exposure</i> .....	5
2.4: <i>Health Effects of Lead</i> .....	8
2.4.1: <i>Lead Regulations in Relevant Countries</i> .....	10
2.4.1A: <i>Lead Levels in Water</i> .....	12
2.4.1B: <i>Protecting Air Quality</i> .....	12
2.4.1C: <i>Presence of Lead in Soil and Paint</i> .....	12
2.5: <i>Methods of Lead Poisoning Prevention</i> .....	13
2.5.1: <i>Prevention in the Home, School, and Workplace</i> .....	13
2.6: <i>Health Risk Communication</i> .....	14
2.6.1: <i>Principles of Health Risk Communication</i> .....	14
2.6.2: <i>Health Risk Communication in the United States and Thailand</i> .....	16
2.6.3: <i>Lead Specific Health Risk Communication</i> .....	18
2.6.4: <i>Participatory Action Research in Health Risk Communication</i> .....	20
2.7: <i>Summary</i> .....	20

Chapter 3: Methodology .....	22
3.1: Process .....	22
3.2: Gain an Understanding of How to Best Educate Students .....	25
3.2: Wat Pathumwanaram Trial .....	27
3.2.1: Wat Pathumwanaram Design .....	27
3.2.1A: Lesson Plans .....	27
3.2.1B: Informational Pamphlet .....	29
3.2.1C: Stickers .....	30
3.2.1D: Healthy Habits Poster .....	31
3.2.2: Implementation at Wat Pathumwanaram .....	32
3.2.3: Wat Pathumwanaram Evaluation .....	33
3.3: Baan Kao Huay Mahad School Trial .....	35
3.3.1: Re-Design of Program for Baan Kao Huay Mahad School .....	35
3.3.2: Implementation at Baan Kao Huay Mahad .....	37
3.3.3: Baan Kao Huay Mahad Evaluation .....	37
Chapter 4: Findings.....	39
Finding #1.....	39
Finding #2.....	41
Finding #3.....	42
Finding #4.....	44
Finding #5.....	46
Finding #6.....	48
Finding #7.....	50
Finding #8.....	52
Chapter 5: Discussion and Conclusions .....	54
5.1: Recommendations about Design and Implementation of Lead Education .....	54
5.2: Sustainability and Feasibility of Lead Educational Programs.....	58
5.3: Final Remarks .....	59
Bibliography .....	61
Appendix .....	66
Field Forms.....	66
Teacher Pre-Interviews.....	66
Student Surveys.....	85
Teacher Post-Interviews.....	100
Deliverables.....	108
Lesson Plan (Grades 1-3).....	108
Lesson Plan (Grades 1-3).....	128
Informational Pamphlet.....	146
Healthy Habits Poster .....	149
Website: Lead Free Community.....	150

# Table of Figures

---

Figure 1: Methodology: Two cycles of Objectives .....	iv
Figure 2: Causal model of lead exposure.....	6
Figure 3: Pathways of child lead exposure.....	8
Figure 4: Change in government policies due to lead exposure knowledge .....	19
Figure 5: Objectives in a cyclical process.....	22
Figure 6: Methodology map.....	24
Figure 7: Wat Pathumwanaram School.....	27
Figure 8: Jeopardy Game.....	29
Figure 9: A student reads an informational pamphlet.....	30
Figure 10: A student wearing a project sticker .....	31
Figure 11: Healthy Habits Poster.....	32
Figure 12: Baan Kao Huay Mahad School .....	35
Figure 13: General consequences of lead.....	43
Figure 14: Student source and prevention method prior knowledge .....	44
Figure 15: Lead source prior knowledge between schools.....	45
Figure 16: Exposure prevention method prior knowledge between schools.....	46
Figure 17: Lead source knowledge gain.....	47
Figure 18: Strength of knowledge about sources of lead.....	48
Figure 19: Exposure prevention method knowledge .....	49
Figure 20: Student strength of knowledge about lead exposure prevention.....	50
Figure 21: Student response to lead safety question.....	51
Figure 22: Result of lead safety questions in both schools.....	52
Figure 23: Student enjoyment results .....	53

# List of Tables

---

Table 1: Chronic Health Effects Caused By Lead Poisoning.....	9
Table 2: Maximum Levels of Lead Concentration Regulations.....	11
Table 3: Principles of Risk Communication .....	15
Table 4: 10 Question Framework.....	15
Table 5: Teacher Interview Feedback .....	26
Table 6: Initial Program Analysis .....	34
Table 7: Final Program Analysis .....	38



# Chapter 1: Introduction

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A clean and safe environment in which to live is desired by most people. In polluted environments, the most vulnerable populations often suffer from disease and may die. For example, lead is a heavy metal that occurs naturally as a mineral (U.S. Department of Health and Human Services, 2007) but has become a toxic contaminant due to the increase of industrial processes, which may release large amounts of lead into the environment. Lead contamination spreads widely to the community around the industrial sites because it can pollute air, water and soil. There have been many reports of acute and chronic sicknesses associated with lead poisoning in communities close to industrial estates and pollution sites (U.S. EPA, n.d.).

Currently, industrial sites are increasing rapidly all over Thailand, especially in the province of Rayong (Hassarungsee, 2010). These industrial companies are publicly associated with an increasing standard of living in the country, but they simultaneously pollute the environment of nearby neighborhoods with lead. Some companies in Rayong are not only creating products that are damaging to the health of the community, but are also polluting the water and air with lead as a by-product of manufacturing (Simachaya, 2004). Subsequently, increased levels of lead have been detected in schools in the surrounding communities (Sarnsamak, 2012). In a recent study conducted by Thammasat University's Faculty of Public Health, 82 of 907 students from five schools around Rayong were found to have lead in their blood system (Sarnsamak, 2012). This is especially troubling because children are one of the population groups most at risk of lead exposure (Mayo Clinic, n.d.; US EPA, n.d.).

To fully understand the reasons behind the prevalence of childhood lead exposure in Thailand, it was necessary to research background information about lead, the sources of lead, pathways of exposure, health effects and methods of prevention. Many methods of lead exposure prevention are possible. However, in the following background chapter, two focal points include governmental lead pollution regulations and informing communities about lead exposure prevention.

During research, it was discovered that Thailand's laws and regulations about lead exposure are lacking when compared to other countries. For example, the United States has comprehensive regulations and programs about lead, and as a result, incidences of lead poisoning are less common than in Thailand (Lead Regulations, 2012). Because the government does not adequately regulate the use of this dangerous chemical in products (such as paint), and school communities are unaware of these hazards, exposure can occur (Pollution Control Department, 2012). Ideally, a polluted site would be cleaned up. The barriers standing in the way of this are that the clean up is expensive, there are few laws holding responsible parties accountable, and no regulations about the methods of lead abatement. This indicated that other preventative measures, such as a public education program, are necessary to reduce the instances of lead exposure in Thai children.

Because of this, Thammasat University's School of Global Studies has sponsored this endeavor. The project team consisted of students from the Faculty of Science in Applied Chemistry (BSAC) at Chulalongkorn University and Worcester Polytechnic Institute. An educational program was developed for children, parents, and school faculty about lead sources, health effects, and how to prevent exposure. The materials created focused mainly on children, however information was also disseminated to parents, teachers and school administrators. Final deliverables included two lesson plans, an informative pamphlet, a healthy habits poster, and stickers. All deliverables were made available to the public on a Thai language website geared towards school communities. Throughout this mission, frameworks for risk communication as well as participatory action research helped in the development of the comprehensive educational program. Considering established frameworks such as these, feedback from the teachers and students, and team observations of implementation allowed for the creation of a sustainable and effective program. Finally, we recommended that this program be implemented in every school in Thailand, to reduce the prevalence of childhood lead exposure.

## Chapter 2: Background

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Extended exposure to lead may cause serious health problems. Since lead has detrimental effects on human health and development, Thailand has enacted some regulations limiting the amount of lead that can be present in air, water and soil. However, these laws are not all fully enforced. Therefore, the presence of lead in the environment continues to be an issue, as shown by the prevalence of lead-related health issues in the country (Sarnsamak, 2012).

This chapter focuses on sources, negative consequences, and methods for preventing or mitigating the harmful effects of lead exposure in Thailand (Figure 1). First, this chapter explores basic chemical information about lead, the sources of lead, pathways of exposure, and the possible health effects of exposure. Second, methods of prevention and mitigation are explored, and how to utilize established risk communication frameworks is discussed. Because there is already lead in the environment in some areas of Thailand, this project emphasizes educating people about lead so they may protect themselves.

### *2.1: Lead Today*

In Thailand today, there are few to no regulations governing the amount of lead that industrial companies can introduce into people's living environments. This has contributed to increased incidences of lead exposure within polluted communities. In this section, examples of exposure will be used to explain the sources, health effects and current regulations of lead (Lead Paint Background, 2012; Control Department, 2012)

In September 2012, a primary school in Rayong was informed that three of its students had lead poisoning. It was believed to be caused by paint used at the school. As mentioned before, Thammasat University's Faculty of Public Health has been investigating this issue. The department took blood samples of 907 students at five schools in Rayong after the September 2012 discovery. Eighty-two of the students were found to have a toxic level of lead in their bodies. Three of these

students had more than four times the medically acceptable limit of 10 mg/dl in their system (Sarnsamak, 2012). Testing several months later revealed that forty children still had lead levels over the safe limit (Samabuddhi, 2012).

### *2.1.1: Consequences of Lead Pollution in Thailand*

The negative effects of lead can be seen frequently in Thailand. In 1979, lead pollution was discovered in ground water and soil when a World Health Organization study was conducted (World Health Organization, 2008). The subjects studied had an average concentration of nearly 100 mg/dL lead in their bloodstream, which is over ten times greater than the safe limit. World Health Organization, 2008). Additionally, groundwater in wells near the homes of local residents in Rayong once reached a concentration of nearly one thousand times the standard limit of .05 mg/dL (World Health Organization, 2008). Today, lead contamination continues to affect Rayong, as shown by the elevated levels of lead found in local children (Sarnsamak, 2012).

The consequences of high levels of lead can impact more than just personal health. This can be seen in the recent court case involving Lead Concentrates (Thailand), the operator of the now defunct Klity Mine. The company was forced to compensate villagers living in nearby Klity Creek for contaminating the creek with lead (Kaewkasi, Suphan). The villagers suffered several negative health effects and the companies that polluted the creek had to pay 35.8 million baht (approximately \$1.2 million) as partial compensation for their health needs.

### *2.2: Chemical Information*

Lead is a naturally occurring heavy metal, found in the earth's crust. Natural lead ore disperses in the environment as a non-toxic substance, *i.e.*, having a concentration of at most 10 parts per million (ppm) (Agency for Toxicology and Environmental Medicine, 2007). It does not occur as 'inorganic lead' unless it combines with other existing elements and minerals such as zinc, silver, and copper (U.S. Department of Health and Human Services, 2007).

However, inorganic lead has become a health threat with man-made compounds being manufactured more frequently. Products containing lead may also be harmful when they are used, not just when they are produced. Industrial workers are the most at-risk group for lead exposure. They pose a health threat during manufacturing because they can cause exposure to workers as well as pollution to the environment. Lead exposure has recently started to spread out to the communities surrounding industrial sites, and now children are also at a great risk.

### *2.3: Sources of Lead and Pathways of Exposure*

Lead is often introduced to the environment as a by-product of burning fossil fuels, mining, and manufacturing (NCDOL, n.d.). Lead can be found in a wide variety of places because it occurs naturally and is spread to air, water and soil as a result of human activity. Figure 2 describes the process of lead's use in manufacturing products and the subsequent pollution that occurs. It shows how pollution enters the body and the resulting health consequences.

Some particularly dangerous areas are industrial sites with lead contamination. Whether or not they are still in use, they may pose a potential public health hazard. Old mines or lead smelters may contribute to high levels of lead in the soil and air of a surrounding community. Lead is naturally present in soil at an average concentration of about 7-20 ppm (Holmgren et al., 1993). The soil is considered contaminated when this value exceeds 20 ppm. Root vegetables grown in farms nearby may uptake lead from soil, and atmospheric lead deposition into leafy vegetables may also occur. Lead may contaminate water through leaching from lead-containing pipes, faucets, and solder (ATSDR-CDC, 2012).

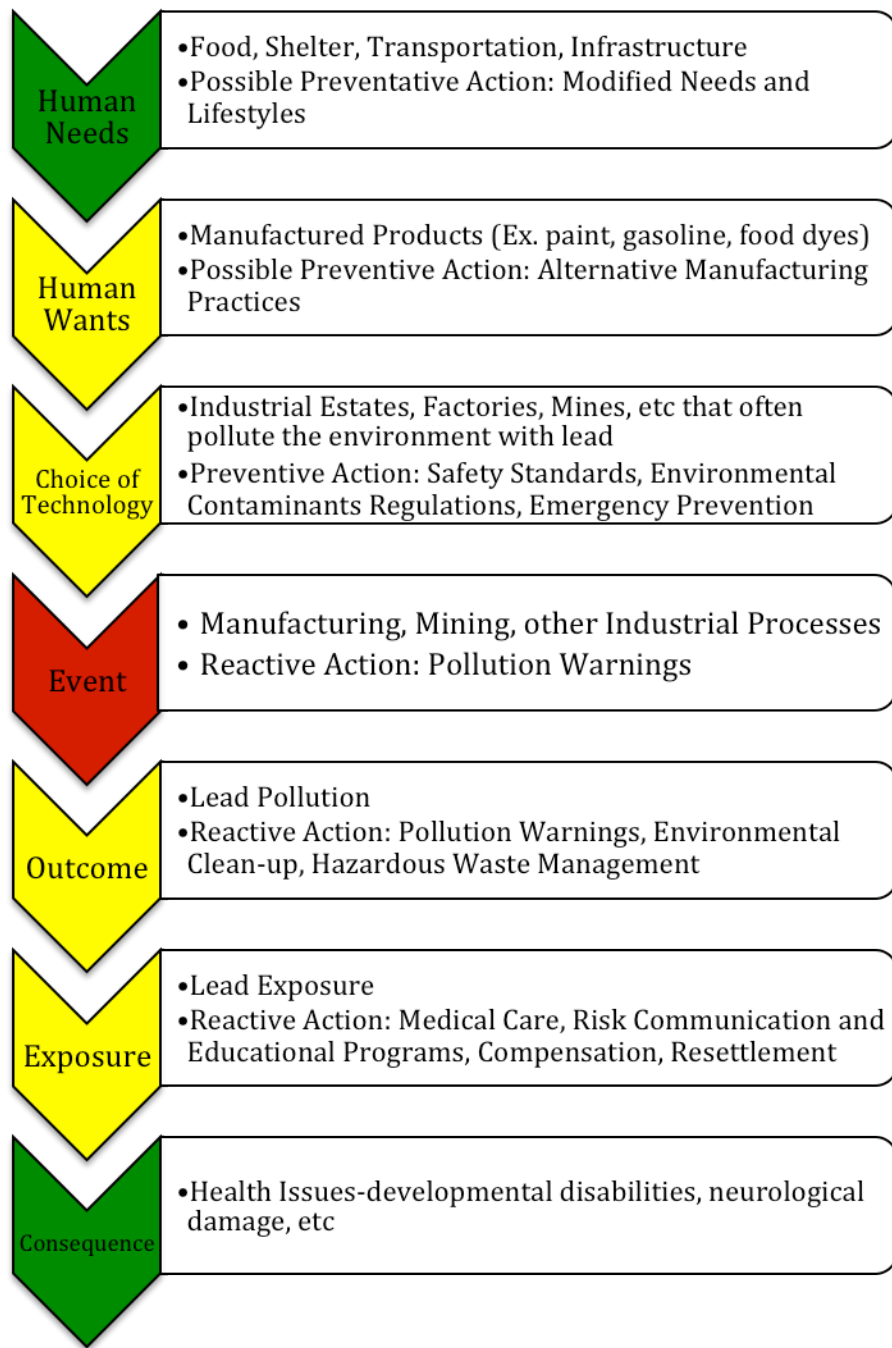


Figure 2: Causal model of lead exposure

Lead's low cost contributes to its use in many products. According to the NIEHS (National Institute of Environmental Health Sciences), "the most common sources of lead exposure in the United States are lead-based paint in older homes, contaminated soil, household dust, drinking water, lead crystal, and lead-glazed

pottery” (NIEHS, n.d.). Lead compounds have also been used in ceramics, pipes, solders, gasoline, batteries, and cosmetics (NIEHS, n.d.).

In fact, the most widespread and dangerous sources of lead exposure are man-made products, such as lead-based paint. The CDC’s website states that, “the most widespread source of lead today for U.S. children is in lead paint that remains in older buildings” (ATSDR-CDC, 2012). In addition, the Secretary of the Department of Health and Human Services has called lead paint the “number one environmental threat to the health of children in the United States” (ATSDR-CDC, 2012).

Figure 3 illustrates how lead in the environment can impact a child and highlights the significance of lead paint as a source of exposure. Harmful amounts of lead can be released when lead-based paint is improperly removed from surfaces by dry scraping, sanding, or open-flame burning (EPA, n.d.). It may also be released into the air when the walls are subject to friction or impact, such as windows scraping against windowsills or doors opening and closing.

Once lead is in the environment, it may easily enter a human being’s blood circulation through different pathways of exposure. Figure 3 uses arrows to represent pathways of exposure. Lead cannot be seen, tasted, or smelled when it contaminates water, food, or drink (US EPA, n.d.) (CDC - ATSDR n.d.). Because of this, lead pollution is extremely dangerous, since people are at risk of unknowingly receiving an internal dose of lead. This relationship between the event that causes pollution and the eventual resulting pollution and consequences is illustrated in Figure 3.

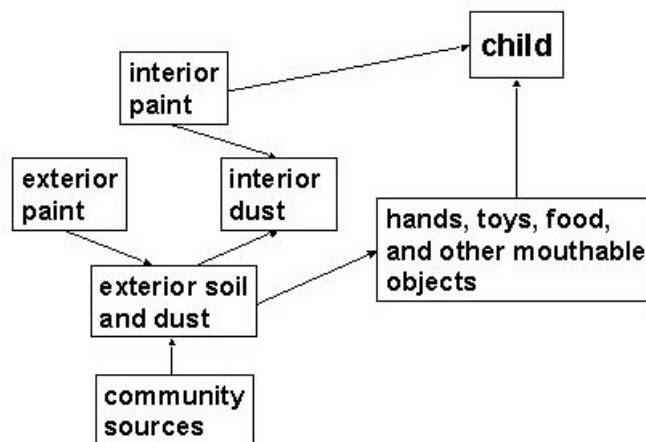


Figure 3: Pathways of child lead exposure

The hazards of lead-based paint cannot be overstated. It is recommended that lead paint be left undisturbed to minimize exposure, or removed by trained professionals so no one receives an internal dose of lead (NCDOL, n.d.).

#### 2.4: Health Effects of Lead

When a person receives an internal dose of lead particles, lead travels through the bloodstream to the soft organs (liver, kidneys, lungs, brain, spleen, muscles, and heart) (ATSDR-CDC, 2012; Mayo Clinic, n.d.). Most commonly, it works its way out of these systems and the majority of lead is eliminated as waste (Mayo Clinic, n.d.). After a few weeks, any remaining lead remaining in the bloodstream is stored within bones. It stays trapped in bones until it is eventually released again through the regular process of breakdown/reformation that is performed daily by bone maintenance cells (Mayo Clinic, n.d.).

Storing a small amount of lead in the body may not be harmful (ATSDR-CDC, 2012; US EPA, n.d.). However, if a human is exposed to a large amount of lead, the body may be unable to eliminate the majority of it and may store dangerously high levels of lead (ATSDR-CDC, 2012; Mayo Clinic, n.d.). Some of this lead may leave the bones and reenter the bloodstream and organs slowly. This may occur quicker during pregnancy, periods of breast-feeding, after a bone is broken, or during periods of bone deterioration (ATSDR-CDC, 2012). If a larger than normal



concentration of lead is in the bloodstream, several different health issues may occur (ATSDR-CDC, 2012; Mayo Clinic, n.d.; US EPA, n.d.).

A medically dangerous blood lead level for an adult is defined as greater than 20 micrograms of lead per one deciliter of blood (20 µg/dL) . For children, a concentration above 10 µg/dL of lead in the blood is a cause for concern (USNLM, 2012). It is important to know the maximum level of lead in the bloodstream that is deemed medically safe, so that conclusions can be drawn about possible health consequences for individuals with levels above these.

Being exposed to lead on a short-term basis may lead to acute health issues such as irritability, loss of appetite, weight loss, fatigue, abdominal pain, vomiting, and constipation (Mayo Clinic, n.d.). When lead builds up in the body over a period of months or years, lead poisoning may occur (Mayo Clinic, n.d). In Table 1, some of the symptoms of this affliction may be seen.

**Table 1: Chronic Health Effects Caused By Lead Poisoning**

Organ System	Effects/Symptoms
Central Nervous System	- Blindness - Partial Deafness - Paralysis - Encephalopathy - Depression
Digestive system	- Inflammation - Severe Stomach Pain - Urinary Retention
Cardiovascular System	- High risk of stroke or heart attack - Anaemia - Hypertension
Cognitive System	- Autism - Learning Difficulties
Renal System	- Kidney damage - Nephritis - Gout
Skeletal System	- Muscle pain - Joint pain - Osteoporosis

These lead-related problems affect children more than any other age group (USNLM, n.d.; US EPA, n.d.; Mayo Clinic, n.d.). The U.S. National Library of Medicine states that “Low levels [of lead] in adults are not thought to be harmful, but in infants and children, low levels of lead can lead to toxicity that may cause deficits in intellectual or cognitive development” (USNLM, n.d.).

The first of three reasons is that children's bodies are especially ill equipped to deal with lead exposure (ATSDR-CDC, n.d.). Second, childhood behavior leads to a greater risk. Young children are more likely to have 'oral exploration' behavior, in which children place many objects into their mouths, including their hands. This results in an easy pathway for lead to be delivered into the body (Government of Alberta, Employment and Immigration, 2009). Third, children absorb more lead and are more sensitive when exposed (ATSDR-CDC, n.d.). In studies conducted by the Center for Disease Control in the United States (CDC), it was found that, "About 99% of the amount of lead taken into the body of an adult will leave in the waste within a couple of weeks, but only about 32% of the lead taken into the body of a child will leave in the waste" (CDC, 2012). Another study confirms this finding, "...for adults who had just eaten, the amount of lead that got into the blood from the stomach was only about 6% of the total amount taken in.... Children absorb about 50% of ingested lead" (CDC, 2012).

Additionally, other risk factors, such as poverty, may play into the prevalence of lead poisoning in Thailand and how young people are affected. Poor children living in communities with developing infrastructure and industry are likely at a greater risk for lead exposure, due to community resource pollution by local factories (DHV, n.d.; Fernquest, 2010).

In summary, children tend to receive a greater dose of lead than adults in similar environments with similar exposures, and therefore children are more prone to suffer from lead-related health issues (ATSDR-CDC, n.d.; HV, n.d.; Mayo Clinic, n.d.).

#### *2.4.1: Lead Regulations in Relevant Countries*

This portion of the background chapter will discuss the differences between lead regulation in the United States and Thailand. Table 2 gives a visual overview of this section, by showing the environmental regulations of lead in the United States and Thailand. The amounts shown below are the maximum permissible levels—a concentration of lead that exceeds these levels is a violation of the law. These laws

were established to prevent lead pollution as well as protect the people from harmful exposure.

**Table 2: Maximum Levels of Lead Concentration Regulations**

<b>United States</b>						
<b>Water</b>			<b>Air</b>	<b>Soil</b>		<b>Paint</b>
<b>Tap</b>	<b>Bottled</b>	<b>Ground</b>	<b>Standards</b>	<b>Inhabited</b>	<b>General</b>	<i>Inspection and removal at state and local level</i>
0.015 mg/L	0.005 mg/L	0.015 mg/L	1.5 ug/ m <sup>3</sup>	400 mg/kg	1200 mg/kg	
<b>Thailand</b>						
<b>Water</b>			<b>Air</b>	<b>Soil</b>		<b>Paint</b>
<b>Tap</b>	<b>Bottled</b>	<b>Ground</b>	<b>Standards</b>	<b>Inhabited</b>	<b>General</b>	<i>Guidelines not enforced</i>
0.05 mg/L	0.05 mg/ dm <sup>3</sup>	0.05 mg/ dm <sup>3</sup>	1.5 ug/ m <sup>3</sup>	400 mg/kg	750 mg/kg	

The scope of lead related guidelines in Thailand are comparable to the United States, however there is definite room for improvement. In Thailand, there are some lead-based materials, such as lead paint, that are not as strictly monitored (PCD, 2012). This is likely due to the lack of a centralized agency devoted solely to environmental protection. There are multiple agencies that have overlapping guidelines. In the United States, the Environmental Protection Agency protects the environment through laws enacted and individual states may hold stricter limits on the laws enacted nationally (US EPA, n.d.). In Thailand, the Ministry of National Resources and Environment and the Pollution Control Department creates regulations on lead pollution and exposure (PCD, 2012). Thailand’s regulations about toxic substances have historically lagged behind more developed countries like the U.S. (U.S.-Thailand Agreement in the Area of Environmental Protection).

In 1999, the United States Environmental Protection Agency signed an agreement with the Ministry of Science, Technology and Environment of Thailand. The agreement determined that the United States would provide technical expertise in environmental protection to Thailand (U.S.-Thailand Agreement in the Area of Environmental Protection). This shows that Thailand recognized that aid was needed in environmental surveillance. Since then, there have been improvements in environmental legislation; however, Thailand's regulations are still not on par with those of the United States.

#### 2.4.1A: Lead Levels in Water

The Thai government set forth regulations regarding the amount of lead that can be present in drinking, bottled and ground water. Whether the water is bottled or from the tap, the amount of lead present cannot exceed 0.05 milligrams per cubic decimeter of water. In the United States, the maximum level allowed for bottled water is much lower than the level for tap water as shown in Table 2. As of 1979, if one does not comply with this standard for bottled water, the guilty party may be fined up to 20,000 baht, imprisoned for up to two years, or both.

#### 2.4.1B: Protecting Air Quality

Similar to the United States, Thailand has recognized the major contributors to air pollution as factories and automobiles, so regulations on emission standards have been set. However, the amount of lead allowed in the air before it is deemed unsafe in Thailand is significantly higher than the allowable limit in the U.S. (Pollution Control Department, 2012).

#### 2.4.1C: Presence of Lead in Soil and Paint

The Enhancement and Conservation of National Environmental Quality Act of 1992 determined the allowable levels of volatile organic compounds, heavy metals and pesticides in soil in Thailand (Pollution Control Department, 2012). The permissible level of lead in soil cannot surpass 400 mg/kg on residential property or farmland, consistent with the level upheld by the United States. Levels of lead in

all other soil are not permitted to exceed 750 mg/kg, which is lower than the value determined by the US EPA (Pollution Control Department, 2012; US EPA, n.d.).

Thailand currently does not have laws regarding the use and removal of lead paint however the awareness of the issue appears to be increasing (Lead Paint Background, 2012). For example, in 2007, the Duang Prateep Foundation's Klong Toey nursery hired a private contractor to remove lead paint from the nursery walls (Baara...Wang, 2012). However, in 2009, the nursery was inadequately cleaned. Retesting revealed there was an increase of lead levels, which made it more dangerous for the children than before the removal of the paint occurred (Baara Wang, 2012) (Child Safety Promotion and Injury Prevention Research Center, 2009). In comparison, the United States has multiple laws surrounding lead paint. Both the Toxic Substances Control Act of 1976 and the Residential Lead-Based Paint Hazard Reduction Act of 1992 establish regulations regarding lead paint. According to federal law, any house or building constructed prior to 1978 must be inspected for the presence of lead before it is leased or sold. If lead paint is found, then the owner of the property receives a court order to have it removed by a certified professional. These laws also exist at the state level and are often stricter (Massresources.org, 2012).

## *2.5: Methods of Lead Poisoning Prevention*

Regulations may be unable to effectively prevent lead from being released into the environment. If this occurs, there are some simple methods of prevention for the household, school, and workplace, which may keep parents and children safe.

### *2.5.1: Prevention in the Home, School, and Workplace*

Lead exposure can affect all members of a family. Evidence shows that healthy habits are effective in preventing lead poisoning and they should be emphasized, for both parents and children (NY State Department of Health, n.d.; US EPA, n.d.). For example, washing one's hands before eating may rinse off harmful contaminants (NY State Department of Health, n.d.; US EPA, n.d.). Meals with rich

iron and calcium content may help regulate the body and compete with lead deposition (US EPA, n.d.).

However, without knowledge of the consequences of lead exposure and healthy habits that may prevent or mitigate lead exposure, people may not be able to protect themselves. Our project seeks to provide people (specifically teachers, parents, and students) with the knowledge to keep themselves safe. In order to provide people with this knowledge, successful health risk communication frameworks can be utilized to ensure that risk and health communication strategies have a foundation of established theory and science.

## *2.6: Health Risk Communication*

Health risk communication is an important method in promoting the understanding of risks. This project focuses on communicating the consequences of lead exposure to Thai school communities to inform them how to prevent exposure. The following sections will provide information on resources for health risk communication in the US and Thailand, and how to address the problems of lead exposure.

### *2.6.1: Principles of Health Risk Communication*

It was important that this program empowered the community and taught how to minimize their exposure, without causing alarm. That is where the importance of using established frameworks of risk communication came in.

A report by the United States Public Health Service discussed working with individuals and communities to weigh the odds in risk communication. They state that risk communication is associated with “dialogue in environmental health decision-making about such community issues as air pollution, hazardous waste sites, lead” (U.S. Public Health Service, 1995). In this report, the department used the principles of risk communication shown below in Table 6.

**Table 3: Principles of Risk Communication**

<b>1</b>	Accept and involve the public as a legitimate partner.
<b>2</b>	Plan carefully and evaluate your efforts.
<b>3</b>	Listen to the public's specific concerns.
<b>4</b>	Be honest, frank, and open.
<b>5</b>	Coordinate and collaborate with other credible sources.
<b>6</b>	Meet the needs of the media.
<b>7</b>	Speak clearly and with compassion.

Another informative framework for a health risk communication program was developed by the Center for Environmental Communication at Rutgers University (Rutgers University, 1994). The framework is based on a set of ten questions that a public health department should ask while creating a new risk communication program. These questions are shown below in Table 4.

**Table 4: 10 Question Framework**

<b>Communicating with the Public</b> Questions to Ask	
<b>1</b>	Why are we communicating?
<b>2</b>	Who is our audience?
<b>3</b>	What does our audience want to know?
<b>4</b>	What do we want to get across?
<b>5</b>	How will we communicate?
<b>6</b>	How will we listen?
<b>7</b>	How will we respond?
<b>8</b>	Who will carry out the plans? When?
<b>9</b>	What problems or barriers have we planned for?
<b>10</b>	Have we succeeded?

These questions provide a basis to create the structure for a new health risk communication program. The question set begins with the simple question of “Why are we communicating?” The intent of this question is to grasp an understanding of what the program will really be used for. This is important because there must be a reason why an organization is creating an educational program. Also, people may not be clear as to what the problem is or the purpose of the program.

The next questions in the framework address the audience of the proposed study. Determining exactly whom the audience is and what they want to know becomes important as an organization needs to know who to target information to and the best way to provide it.

Once an organization has determined why they are communicating and what their audience wants to know, it is appropriate to develop a program to best fit this community. This will answer questions 4-8 in Table 4. These questions refer to the information in which the program will be based upon, how to best communicate to the audience, how the organization plans to listen to feedback, and how the organization plans to respond to feedback. This is the most complicated portion of creating an educational program. This involves a copious amount of research on the subject matter and how the audience will best retain information. These questions will constantly need to be answered to ensure a best possible program.

Finally, after creating the educational program, the organization must implement, obtain feedback, and rework the design to best fit the population. This answers the question “Have we succeeded?” The question also goes back to ensure each subsequent question has been answered. The program is only successful if each question before the final topic has been satisfied.

### *2.6.2: Health Risk Communication in the United States and Thailand*

A successful health risk communication program is very difficult to achieve. The United States Department of Health and Human Services exerts a constant effort to develop successful health risk communication across the country. Some health risk communication topics that are developed by this governmental department include environmental health, environmental health education, toxic substances,



public health issues, and human health (U.S. Department of Health and Human Services, n.d.) This shows that there are many governmental resources for public health divisions that deal with program development within a community in the United States. They include funding, informative material, research, and guidelines. These resources provide all the information public health departments across the United States would need to create their own risk communication programs. Examples of resources that are used during the design of an educational program include topics such as communication fundamentals, communicating complex information, assessing personal strengths and weaknesses, and presenting information at public meetings (U.S. Department of Health and Human Services, 2002). These resources were very helpful in designing this educational program because they provided information that would allow for a program design to be accepted by the community.

Health risk communication in Thailand is very different than in the United States. This may be a result of the lack of rules and regulations regarding public health communication in Thailand. In a previous Interactive Qualifying Project with Worcester Polytechnic Institute and Chulalongkorn University, students observed very low levels of resources for risk communication program development in Rayong. (Chaiwattanoj... Shapiro, 2009). The group of students examined three issues found to be of high risk in Rayong. They interviewed stakeholders who had involvement in the actions of these risks, and determined that multiple stakeholders were approaching the risk communication of these concerns differently. This posed a problem because the public was receiving different information and communication materials simultaneously. This confused the public and resulted in no action. They concluded, "stakeholders [need to] collaborate to share the same information. Collaboration between each of the stakeholders classes could make the same information accessible to all and allow stakeholders to share their information easily and efficiently." (Chaiwattanoj...Shapiro, 2009, p.n. 51). This means that if public health divisions work together to share the same information on specific risks, the information will be consistent. This will allow for successful programs and a change in the audiences' actions relating to various risk factors.

### *2.6.3: Lead Specific Health Risk Communication*

Lead exposure has always been a topic of great focus for the United States Department of Health and Human Services (US Department of Health and Human Services, 2012) and successful risk communication programs have been implemented. The following programs provided a basis for creating this educational program. The materials were helpful in gaining preliminary insight as well as contextual input.

The first example of a successful program is titled “Healthy Homes and Lead Hazard Control”, which provides funds to state and local governments to develop cost-effective ways to reduce lead-based paint hazards.

A second example of a health risk communication program about lead for children can be found on the New York Department of Health’s website. This website contains examples of stories, coloring books, songs, lesson plans, and posters about lead safety for children. Each material mentions ways to prevent lead exposure in children, from diet to sanitary habits (Lead Poisoning Prevention, n.d.).

Another resource for the public is the US EPA’s website, which contains information about lead levels in specific states, free informational pamphlets, and countless other resources which may be used as a basis upon which to create a successful educational program (US EPA, n.d.).

An example of a study regarding results of lead education programs suggests what types of programs are most successful and what types of communication material works best. In August of 2012, the Division of Emergency and Environmental Health Services at the National Center for Environmental Health published a study titled “Lead in Drinking Water and Human Blood Lead Levels in the United States”. The study focused on the health effects of lead on the human body. It emphasized not only the impacts of lead on adults, but also the effects on children. Researchers studied lead in children’s’ environments, as well as the history of lead in drinking water. After relaying informative material regarding high levels of lead, the authors conclude with “Although EPA has the primary responsibility for ensuring the safety of drinking water, state and local childhood lead poisoning prevention programs are important partners in ensuring that the

public is protected from lead exposure,” (Brown and Margolis, 2012). This statement shows that health risk programs are essential to a healthy community. Although there are governmental committees that are responsible for ensuring low lead levels in the environment, there is always a need for local health risk communication programs. “Childhood lead poisoning prevention programs routinely provide information on practices that minimize exposure to lead in water.” (Brown and Margolis, 2012).

This reflects how health risk educational programs can affect governmental regulations on public health. Figure 4 shows that after recorded instances of high blood levels of lead in the United States, legislation was enacted to help alleviate the problem. In 1976, the prevalence of blood levels above 10 ug/dL in children was approximately 90 percent. This is a dangerous statistic and since that discovery, more regulation was put in place to prevent that from happening again. An increase in health risk communication programs within a community often correlates to an increase in laws and regulations regarding risks because the public is more aware of the risks posed to them.

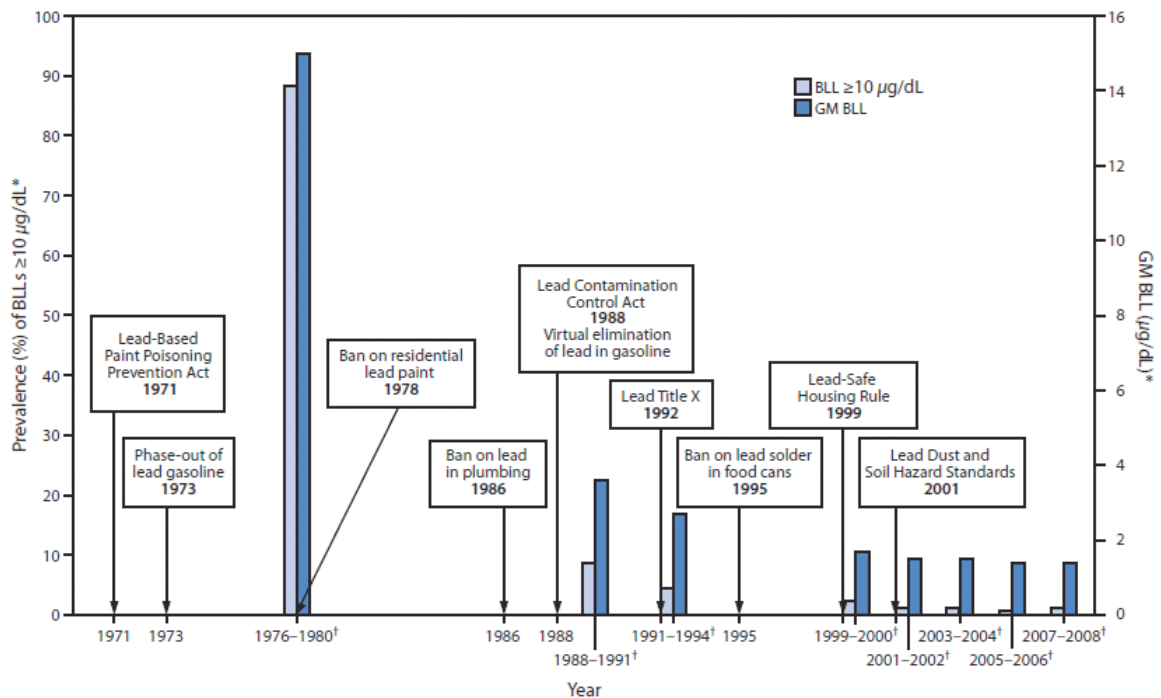


Figure 4: Change in government policies due to lead exposure knowledge

#### *2.6.4: Participatory Action Research in Health Risk Communication*

During research of health risk communication programs, we found that the most successful programs are designed with the audience in mind. We also observed that asking the audience questions and getting them involved as much as possible resulted in a very successful program. The community can feel proud of and excited to act in the direction that the program has led them in. This is participatory action research.

With the knowledge of participatory action research in mind, our research revealed various statements and question sets by health risk communication departments that assist with the development of a new program. These structures would help us form a framework for our educational program. In turn, the guidelines and questions would permit us to be constantly keeping the audience in mind to produce the best possible program. By using participatory action research, the organization can keep the population involved during the creation of the educational program so that they will feel safe while learning about risks.

#### *2.7: Summary*

This background chapter reviewed the current incidence of lead exposure in Thailand, chemical information about lead, sources and pathways of exposure, health effects caused by exposure, methods of prevention and mitigation, lead regulations in Thailand and the United States, and established risk communication frameworks. This structure of lead poisoning prevalence was examined using a causal chain (see in Figure 2). Discussing these subjects exposed a societal problem—lead pollution occurs more frequently because regulations are not enforced enough to be effective (Lead Regulations, n.d.; PCD, 2012). This leads to lead exposure, particularly in susceptible population groups, like young children (US EPA, n.d.).

After pollution and exposure have occurred, there is need to educate community members so that they may protect themselves. People living in polluted communities need information about how to avoid receiving an internal dose of lead. The people of Thailand need to be informed of how to live a healthy lifestyle

and require more knowledge of lead pollution and how to avoid exposure. Being aware of what lead is, the sources of lead, and the dangers of exposure will educate people about how to avoid harmful environments. This in turn will decrease exposure and ultimately reduce health risks caused by lead.

## Chapter 3: Methodology

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The goal of this project was to reduce the health effects caused by lead exposure for students, families, and teachers in schools in Thailand by informing them about the sources of lead, dangers of exposure and prevention methods. Our project team assisted the School of Global Studies at Thammasat University to educate communities that have been impacted by the effects of lead contamination. Educational materials were developed and tested at public schools in Thailand to find the most effective approach of informing the public about lead exposure prevention.

### 3.1: Process

To accomplish the project goal, we completed four objectives:

1. Gained an understanding of how to most effectively educate school communities in Thailand,
2. Designed an educational program to inform students, families and teachers about lead exposure,
3. Implemented the educational program in Bangkok and Rayong, and
4. Evaluated the effectiveness of the program to ensure that the project goals were accomplished and adjusted the program as necessary.

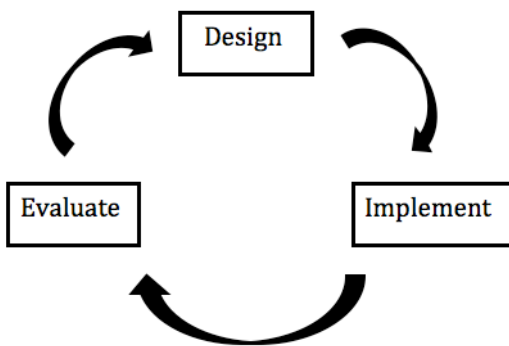


Figure 5: Objectives in a cyclical process

We placed these objectives in a cyclical process, as shown by Figure 5. This ensured that the process could be repeated as many times as necessary to create the most effective product.

In this project, the cycle was executed two times. Figure 6 depicts the methodology of our project, in detail. The green boxes represent the first phase of testing and the yellow boxes represent the second phase. After this process was complete, final deliverables were prepared, which is represented by the red box.

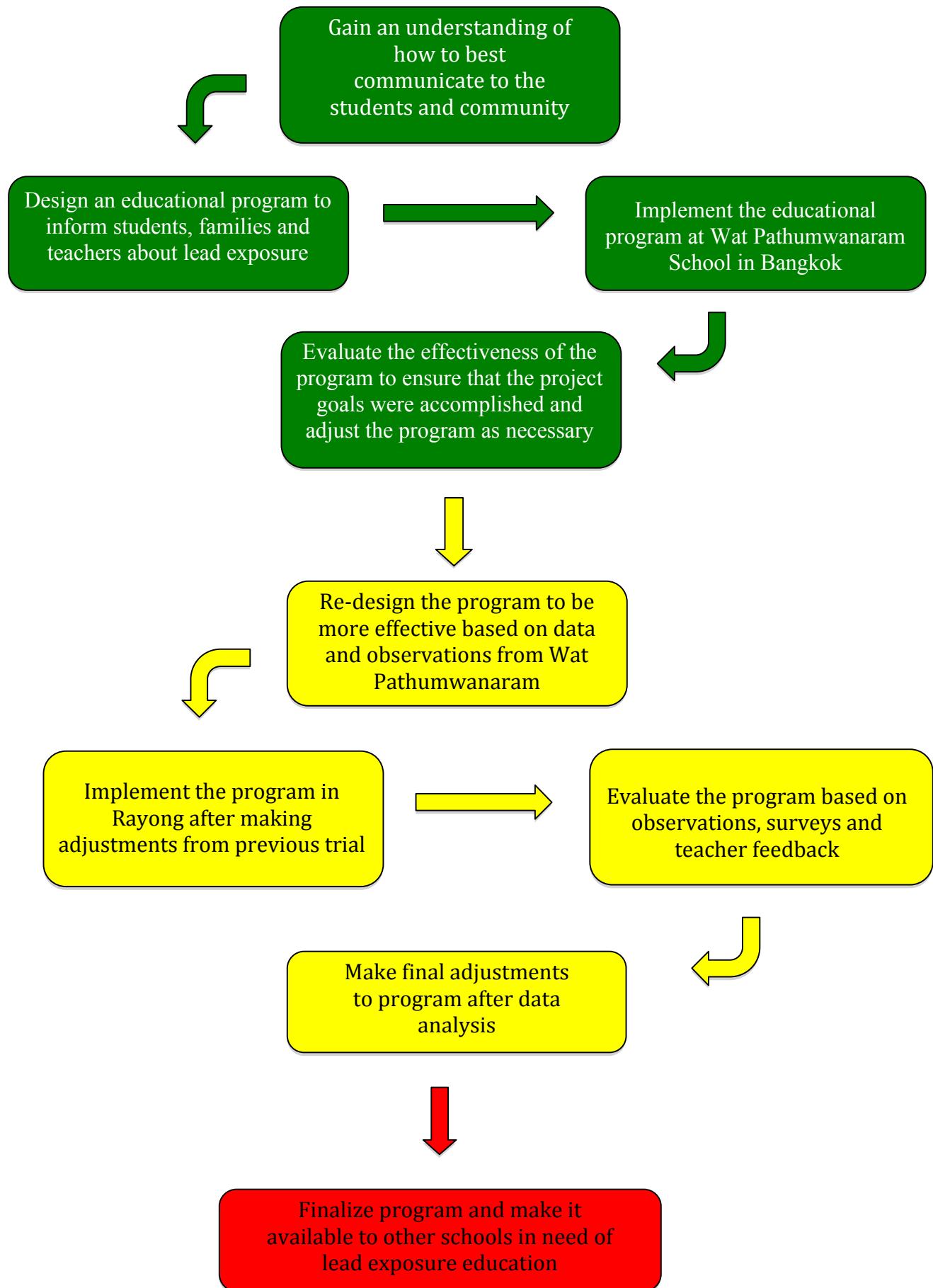


Figure 6: Methodology map



### *3.2: Gain an Understanding of How to Best Educate Students*

Before designing our program, we considered various lead poisoning prevention programs, such as those created and implemented in the United States. Using these established programs, we gathered information about what to include in an educational program about lead for children—for example, including pictures as visual aids and creative stories to convey information.

The faculty at Wat Pathumwanaram was also a strong resource. We met with the administration of the school initially to present the idea of our program. Based on this meeting, we were introduced to five teachers, one each from grades 1-5. We interviewed the teachers and learned valuable information. This included how their students learn best, what types of lessons they enjoy, and what knowledge their students need to know. Individual teacher interview results can be seen in the Field Forms section of the Appendix. This participatory action research allowed us to gather information to put into the program. Although the information and advice from the interviews varied greatly from each teacher, there were underlying themes from all of the interviews. These are represented in Table 5.

Table 5: Teacher Interview Feedback

Aspect of Lesson	Teacher Input
Student Surveys	<ul style="list-style-type: none"> <li>• The older students could do a short answer survey, the younger students could not.</li> <li>• The younger students may need the teacher to read the survey questions out loud.</li> <li>• The multiple-choice questions should have the same number of options to choose from (no more than 4).</li> </ul>
Lesson Duration	<ul style="list-style-type: none"> <li>• Teachers wanted the lesson to occur all in one day, not split up over multiple days.</li> <li>• The informative part of the lesson should not exceed 30 minutes however the game can be longer.</li> </ul>
Lesson Style	<ul style="list-style-type: none"> <li>• Students prefer games and interactive lessons to lectures.</li> </ul>
Strategies for Success	<ul style="list-style-type: none"> <li>• The students like to be singled out and recognized for something positive.</li> <li>• The students are competitive.</li> <li>• Prizes would motivate the students to do better.</li> </ul>

### 3.2: *Wat Pathumwanaram Trial*



Figure 7: Wat Pathumwanaram School

Wat Pathumwanaram School, under the Royal Patronage of H.R.H. Princess Maha Chakri Sirindhorn, is a public school in Bangkok, Thailand (see Figure 7). This school has a history of constantly seeking to improve its quality of education (May, 2007). In recent years, the school has worked with Worcester Polytechnic Institute and Chulalongkorn University project teams to better the education of its pupils. We chose to do initial testing at this school because there is no controversy amount the school community regarding lead exposure. Therefore, we believed that parents, teachers, and the students would be less tense about the issue.

#### 3.2.1: *Wat Pathumwanaram Design*

When designing the initial program to be implemented in Bangkok, the information gathered from Objective 1 established a strong backbone. The project was designed around the main concepts that this research suggested, such as games, participation and tests of knowledge with rewards.

The following are various deliverables that we designed for our educational program

##### 3.2.1A: *Lesson Plans*

We designed two lesson plans. One lesson plan for younger students (grades 1-3) and one lesson plan for older students (grades 4-6). The lesson plans are written in Thai and completely comprehensive. They include student surveys, instructions, games, and other supplementary material.

The lesson for the younger group of students (grades 1-3) contains a dynamic story. This short story features Lead Boy and Lead Girl, two young super heroes that save students from lead poisoning. Lead Boy and Lead Girl are a consistent theme throughout our program. The story is a PowerPoint presentation equipped with animations and voice recordings. It informs students about the sources of lead, how it can get into the body and ways to prevent lead exposure. The script for this story is included in the lesson plan. This method was chosen because in many established lead education programs, stories were used to convey information to the students in a fun way. Additionally, interviewed teachers stated that stories with pictures and animations would keep the students' attention.

In addition to the script for the story, directions for a quiz game, Soi Dao, are provided. Soi Dao, or "Lucky Star" is a traditional Thai game that we adapted for our program. Paper stars attached to a string are hung in the classroom. Each star has a number on it that corresponds to a question in the teacher lesson plan. The students are put in groups of two or three and pull a star off of the string. When the number on their star is called, the students answer a question about lead exposure. These questions were all related to information provided in the short story. We also included a template for the paper stars that teachers can print and cut out. Frequently, games are a method used to test knowledge gained through a lesson and using a game that the students are comfortable with allows for easier participation. The teachers suggested that this would be an enjoyable way for the students to express their knowledge.

The lesson for the older group of students (grades 4-6) includes an interactive PowerPoint presentation to convey information about lead. Lecture notes are provided in the lesson plan. The presentation was designed to convey information in a creative way, encouraging student participation. Research supports that lessons in which students participate lead to a greater understanding of the material. Also, Table 5 shows that teachers prefer interactive lessons for their students.

In addition to the presentation, a Jeopardy style quiz game is present to test the older students. The categories of the game include sources, health effects and

prevention methods. Teams compete to answer questions based upon the lecture information provided. The winning team is rewarded and, as suggested by teachers, given positive compliments in front of the class. As previously mentioned, games have been frequently suggested as an effective teaching method. Figure 8 shows a screenshot of the Jeopardy board.

สาเหตุ	ผลกระทบ	วิธีป้องกัน
100	100	100
200	200	200
300	300	300
400	400	400
500	500	500

Figure 8: Jeopardy Game

Surveys are included in the lesson plan as another tool to gauge student knowledge. The student surveys are to be administered before and after the lesson. They ask questions about the sources of lead, basic consequences of lead and prevention methods. These surveys serve not only as a source of data, but a way for students to confirm their knowledge.

Both lesson plans can be viewed in the Appendix.

### 3.2.1B: Informational Pamphlet

In order to spread information to the entire school community, an informational pamphlet for adults is provided in the educational program. It is

designed for students to take home to parents and serve as supplemental information for teachers and administration. Figure 9 shows a picture of a student reading the informational pamphlet.



**Figure 9: A student reads an informational pamphlet**

The informational pamphlet features a colorful title page with images of Lead Boy and Lead Girl. The pamphlet then opens up to a tri-fold brochure which includes information on what the chemical lead is, how lead can affect the body, and what one can do to protect oneself.

### **3.2.1C: Stickers**

Stickers featuring Lead Boy and Lead Girl are also available in the educational program. All four of the sticker designs include the phrase “Lead-Free Community”, a recurring theme of this program. The stickers are visually appealing and creative. Figure 10 shows a student wearing a sticker.



Figure 10: A student wearing a project sticker

### *3.2.1D: Healthy Habits Poster*

A poster was designed to be displayed in common areas of schools to remind the students and teachers of what they had learned. It features basic information on the chemical lead and then provides steps one may take to protect themselves in the Thai language. These steps include “Wash hands, no toys in mouth, eat healthy food, and avoid chipping paint”. Next to each preventative step is a visual of the step to help the younger students understand. The poster can be seen in Figure 11.



Figure 11: Healthy Habits Poster

### 3.2.2: Implementation at Wat Pathumwanaram

After the design phase was complete, we then implemented the first draft of our program at Wat Pathumwanaram. We visited five classrooms, one from each grade 1-5. Administering pre-surveys was the first step of the program. Grades 1-3 watched the short story presentation about Lead Boy and Lead Girl and then played Soi Dao. Grades 4-5 took part in the interactive lecture and then played the Jeopardy trivia game. All students took the post-survey at the end of their lessons, and were given a sticker once completed. They also received the pamphlet to bring home to their parents.



### *3.2.3: Wat Pathumwanaram Evaluation*

The effectiveness of the program was evaluated based on the results of the surveys as well as observations in the classroom during the lessons. We also surveyed the teachers after the lesson for an evaluation of the program, success with the deliverables created, and personal suggestions. The teachers were asked about changes they would make to the program and if they would feel comfortable giving the lesson on their own. Their feedback, along with the results from the student surveys, helped us modify our program for implementation in Rayong. Table 6 shows the evaluations broken down by source. To view the student and teacher survey results, please refer to the Appendix.

Table 6: Initial Program Analysis

<b>Initial Program Analysis</b>			
<b>Section</b>	<b>Source</b>	<b>Bangkok Evaluation</b>	<b>Rayong Re-Design</b>
<b>Lesson Plan 1-3</b>	Survey	68% of students knew about air, 65% knew about tap water, 73% knew milk as prevention	Revised Short Story to include more information about tap water and air as sources and milk as prevention method
	Team Observation	The students became uninterested at points	Added more animations to short story
	Teacher	“Some [Soi Dao] questions were hard...to answer”	Edited Soi Dao questions to be easier
	Team Observation	3 <sup>rd</sup> Grade Bangkok did not have the option to select multiple answers for question 5 on their surveys	Added ability to select multiple answers to surveys
<b>Lesson Plan 4-6</b>	Teacher	“[the students] found it was hard to remember the name of chemistry.”	More information regarding the chemistry of lead in PowerPoint
	Team Observation	The lesson took longer than anticipated and the kids had trouble answering the hardest questions.	600 category removed from Jeopardy game
	Team Observation	The students filled the surveys out hastily and the different type of answer made data collection more difficult	Open-ended questions eliminated from surveys
<b>Surveys</b>	Team Observation	The ability to compare age groups was difficult.	Surveys synchronized to be the same for both lesson plans
	Survey	65% of students knew about air as a source of lead.	Dirt and air options combined on survey
	Sponsor	Painted toys are a common source of exposure that is similar to painted playground.	Painted toys and playgrounds added as an option
	Survey	64% of students felt safe from lead. This was not a satisfactory number to us.	“Do you feel safe from lead” changed to “Do you know how to protect yourself from lead” on surveys
	Sponsor	Informed us that exercise is not a great method of lead prevention. Also requested that artificial food dyes be included as a source	Exercise was replaced on the survey with “Eat Calcium, Iron and Vitamin C”. Also, “Colorful Food with Dyes” was added to the surveys as a source of lead.

### 3.3: Baan Kao Huay Mahad School Trial



Figure 12: Baan Kao Huay Mahad School

Following evaluation of our program in Bangkok, we presented our plans to the administration at the Baan Kao Huay Mahad School in Rayong, Thailand. Baan Kao Huay Mahad School, shown in Figure 12, is a small school, with each grade consisting of one class with around 15 students in each class. By contrast, Wat Pathumwanaram had multiple classes in each grade and each individual class had approximately 35 students. At Baan Kao Huay Mahad, 21 students were tested for lead exposure and 7 of them exhibited dangerous lead levels. When these results were discovered, a doctor presented information on lead safety to the students at this school. After a meeting at Baan Kao Huay Mahad, the administration consented to implementation of our program because some students that exhibited high lead levels in 2011 still had lead in their blood (Sarnsamak, 2012).

#### 3.3.1: Re-Design of Program for Baan Kao Huay Mahad School

Based upon results of student surveys, teacher post-surveys, and personal observations in Bangkok, we were able to evaluate the program. The evaluations revealed the necessary areas to address program ineffectiveness and other factors. The re-design for Rayong can be seen in Table 6.

We also made an addition to our educational program at this time. We created a website entitled “Lead Free Community”. (<http://sites.google.com/site/leadfreecommunity>). This website is completely in

Thai and acts as a resource for students, teachers, administrators, parents, and any other community members interested in learning more about the chemical lead, it's effects, and preventative measures.

The website features multiple pages. First is a home page, which includes an introduction to the website, Lead Boy and Lead Girl, as well as a map of the schools that we implemented our program at. We also included an informational video about lead poisoning in children. Our contact information is also listed for any visitors that have questions or comments on our website or program.

The second page on the website is designated for children. This page contains download links to the four stickers featuring Lead Boy and Lead Girl for their enjoyment. It also includes the short story animation designed for the younger students' lesson plan.

The third tab on our website is a page for parents. This page describes our program and gives an overview of what information we are trying to teach to the community. It also contains a download link to the pamphlet that was sent home with the students for more information.

The fourth page on our website is designated for the teachers of schools that wish to implement our lessons. This page provides a brief description of our program and many download links for all materials necessary to perform the program. These links include the lesson plans (grades 1-3 and 4-6), the short story animation designated for grades 1-3, the interactive PowerPoint presentation designated for grades 4-6, and the pamphlet designed for adults for additional information. We wanted to make our program as accessible to teachers as possible, so this way, any school interested may immediately download our materials and run the program in their classrooms. This page also includes a link to our YouTube channel, LeadFreeCommunity (<http://www.youtube.com/user/LeadFreeCommunity>), which contains videos of our program's implementation. These videos are intended for teachers to view and help them feel more comfortable while teaching our lesson plans. We feel that if teachers view the lessons being run, it will give them an idea of how to go about teaching our material.

The fifth tab on the website is for administrators of schools in Thailand. This page also includes a brief description of our program and multiple download links, including the stickers of Lead Boy and Lead Girl, the informational pamphlet, and the healthy habits poster.

The sixth and final page on our website contains useful links that any viewer may investigate for more information on lead and our project team's institutions.

This website went through various changes throughout developmental stages of our educational program. This type of resource can always be modified and updated.

### *3.3.2: Implementation at Baan Kao Huay Mahad*

With these revisions, we then implemented our program at Baan Kao Huay Mahad School in Rayong, Thailand. We taught the lesson to two classrooms, one grade 3 class and one grade 5 class. Student pre-surveys were administered before the lesson to judge their prior knowledge. The grade 3 class then went on to watch the short story video and play the revised Soi Dao game. Grade 5 took part in the interactive lecture and then played the Jeopardy trivia game. All students took the post-survey at the end of the lessons and were given a sticker once completed. Finally, the students received the informational pamphlet to bring home to their parents.

### *3.3.3: Baan Kao Huay Mahad Evaluation*

The effectiveness of the program was evaluated again based on the results of the surveys, as well as observations in the classroom during the lessons. We also interviewed the teacher who assisted our implementation after the lessons were complete. She was asked about changes she would make to the program and if she would feel comfortable giving the lesson on her own. Her feedback, along with the results from the student surveys, helped us modify our program again. To view our exact results, please refer to the Appendix. Table 8 shows the evaluations, broken down by source. Once the evaluations were complete, we were able to make final revisions and produce a best possible program.

Table 7: Final Program Analysis

<b>Final Program Analysis</b>			
<b>Section</b>	<b>Source</b>	<b>Rayong Evaluation</b>	<b>Final Re-Design</b>
<b>Lesson Plan 1-3</b>	Teacher	“[It would be better if] there is the subtitle under the slide for them to follow along the storyline easily.”	Added Subtitles to Short Story Movie
	Teacher	“I would like you to add the conclusion slide...So that after the story, they can gather the information on their minds.”	Conclusion slide was added to short story to address these issues
	Survey	3 of 4 sources of lead recognized by less than 76% of students	New conclusion slide highlights toys and playgrounds, dirt and air and colorful food with dyes
	Survey	3 of 4 lead exposure prevention methods recognized by less than 76% of students	New conclusion slide highlights no toys in mouth, drink milk and eat calcium, iron and vitamin c.
<b>Lesson Plan 4-6</b>	Teacher	“I would like you to add the conclusion slide...So that after the story, they can gather the information on their minds.”	Added conclusion slide to the end of the lecture
	Survey	Less than 80% of students recognized “Eat Calcium, Iron and Vitamin C” and “No Toys in Mouth”	Although these are strong numbers, the new conclusion slide specifically highlighted these issues.

## Chapter 4: Findings

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Analyzing results is a crucial aspect of creating a successful and effective program. The quantitative results collected from program implementation were gathered from student and teacher surveys. As stated before, the cycle of design, implementation and evaluation was repeated two times in this project. Therefore, result analysis was performed twice in order to re-design the program and address knowledge gaps revealed from the data.

During initial testing in Bangkok, different surveys were used for the younger and older students, leading to differing survey group sizes in the data. However, data in these cases are presented in percent form rather than in total numbers, as to more fairly represent the information. The full data tables may be seen in the Appendix. While testing in Rayong, both age groups filled out the same survey, making it possible to generate universal data about student knowledge gain. Two of the student survey questions included four choices of answers, each regarding lead sources and preventative measures. The exact questions may be seen in the Appendix. The answers were all accurate, meaning that choosing all four options per question would be correct. In order to view these results easier, it was decided to categorize 1-2 selections as weak knowledge and 3-4 selections as strong knowledge. This concept will be referred to throughout this chapter.

In Rayong, one teacher was part of both test classes, and the survey was administered orally. The teacher surveys administered in Bangkok were completed by four of the five teachers involved in the program. The survey questions were related to program success, student knowledge and program improvement. The full transcripts may be viewed in the Appendix.

### *Finding #1*

#### **Students learn best through games, participation and rewards.**

In order to discover how to best educate students, particularly in Thailand, research was conducted. Firstly, a literature review was conducted by examining

existing lead education programs. This provided insight into general education methods. In order to gain more information about Thai students specifically, schoolteachers were interviewed. These interviews revealed valuable information as to how Thai students learn best, pay the most attention and enjoy gaining information. Interviews were conducted at Wat Pathumwanaram School, under Royal Patronage of H.R.H. Princess Maha Chakri Sirindhorn in Bangkok.

The first way that we found students learn best was through games. Many reviews of current lead education programs for elementary schools implemented in the United States and Europe showed examples of playing games that involved quizzing the students about what objects contain lead. One example comes from The Los Angeles County Department of Public Health in the United States. This lesson plan instructs teachers to tell a story and show images during various key words that are important for the students to retain, like lead containing objects and lead safe objects. Then the students would play a game. This game consisted of every student using a magazine to cut out two types of objects; objects that may contain lead and objects that are safe from lead (Los Angeles County, Department of Public Health, 2012). This game would be enjoyable for the students, but also teach them about the sources of lead exposure.

The teacher interviews also reflected this finding. The teachers at Wat Pathumwanaram stated that “activities are necessary for their attention” and “craft project or art work is the most effective, then games”. These answers confirmed that students learn well through the use of games in lessons.

Another finding during this investigation was that students learn best while they are actively participating in a lesson. We found this to be true in current lead education programs, as well. There were many lesson plans that included a story. The teacher would read these stories and the students would participate by answering simple questions regarding the story. This type of lesson was also included in Los Angeles County’s Lesson in Lead Curriculum. (Los Angeles County, Department of Public Health, 2012).

The teachers at Wat Pathum Wanaram also felt that lessons that include student participation are essential in keeping classroom attention. This would result



in a higher increase in knowledge. The teachers stated, “the young kids...can focus for about 30 minutes” and “I would create the story book with a lot of pictures and...cute cartoon figures”. They also explained that if the students are constantly involved and asked questions throughout lessons or stories, they would pay attention longer.

Finally, the teachers at Wat Pathumwanaram also stressed the idea of rewards for students who pay attention and answer questions correctly. We did not find any examples of this in our literature review, however we still categorize this as an important finding. The teachers stated that, “some prizes will encourage them a little more” and “They like to be complimented. The students with compliments always feel that they are the shine to the classroom and other students want to shine as well.” Rewarding students with a prize may be a very common act in Thailand, and because the teachers felt this way, we wanted to reward students with a prize during the program.

## *Finding #2*

### **Lack of knowledge about lead exposure is associated with a lower willingness of teachers to educate their students about lead.**

At the school in Bangkok, lead has not been a topic of controversy and overall knowledge on the subject is low among the teachers and students. At the beginning of the project, this low level of knowledge was viewed as favorable because greater increases of awareness were expected. However, this lack of knowledge proved to be troublesome. At Wat Pathumwanaram, the teachers were not very accepting of the program. During meetings with the school administration, the teachers seemed very resistant to the program and did not like having to make room in their busy schedule for something they viewed as a non-issue. This reaction was very frustrating, especially due to growing evidence that lead exposure is a problem throughout Thailand.

The administrators in Bangkok, however, proved to be very helpful. The director was very welcoming of the educational program and felt that it was important information in fostering a healthy school environment. This backing was

crucial, because without it, the teachers may have refused to implement the program at all. Although this was a frustrating process, it is understandable that teachers do not want to spend time on something that they don't believe to be a problem. When asked if the parents would be interested in this program a teacher responded, "I think they might be interested in [the lead program]." If this were a large issue, all the parents would definitely care and want to know about the program. However, this is not a pressing issue in Bangkok, which was reflected in teacher attitudes.

When visiting Rayong, this issue was not discussed at all. The school has experienced lead issues for over a year with controversy surrounding pollution. Immediately, both teachers and administrators were accepting of the program and appreciated our project team for choosing their school for implementation. Although this finding may seem obvious, it was determined that in order for individual teachers to fully appreciate and welcome this educational program, there either needs to be prior knowledge regarding lead or administration influence in implementation.

### *Finding #3*

#### **Students had substantial prior knowledge regarding the general consequences of lead but lacked awareness about lead sources and exposure prevention methods.**

Students that participated in this study were aware of the general consequences of lead prior to program implementation. To gauge this knowledge, two general survey questions asked of students were "Can chemicals in the environment be unhealthy?" and "Can lead make you sick?" These questions are fundamental issues of this program that need to be expressed.

### Pre-Survey Negative Consequence Knowledge (All Students)

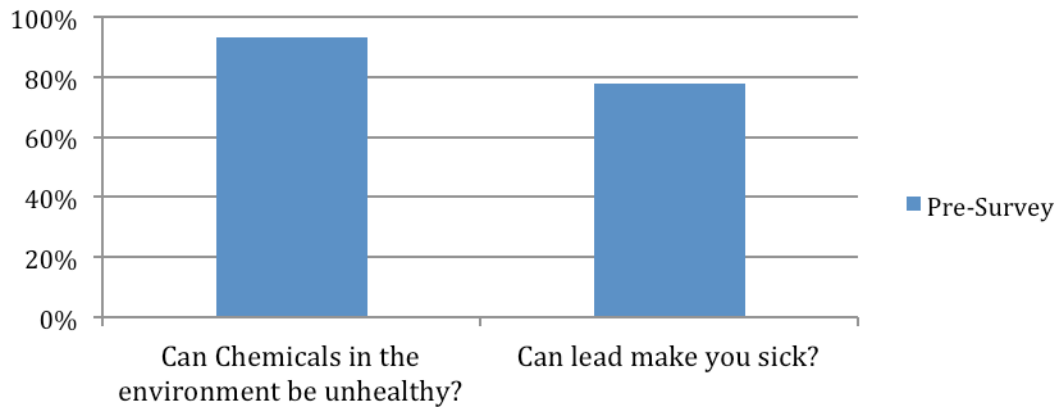


Figure 13: General consequences of lead

As shown in Figure 13, 92% of students surveyed prior to the program knew that chemicals in the environment could be unhealthy. This is a very high percentage, especially considering that first and second grade students participated. Three quarters of the students knew that lead could make a person sick.

Students at both schools had this level of background knowledge about general consequences, however their awareness about more specific issues was much less. Figure 14 shows that only 23% of students had strong knowledge regarding lead sources. This means that 77% of students could only recognize 0-2 sources of lead on the pre-survey. Nearly identical numbers were discovered regarding exposure prevention methods. 76% of students were not adequately aware of how to protect themselves from lead.

# Student Prior Knowledge

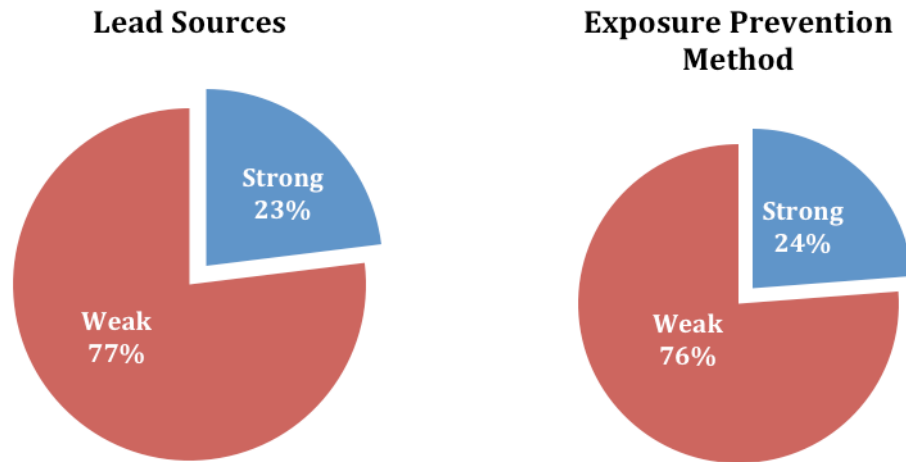


Figure 14: Student source and prevention method prior knowledge

This means that only one in four students possessed detailed knowledge as to how to avoid lead exposure. Although background understanding about lead exposure existed within students, they were not aware of how to protect themselves from lead. This provided a strong stimulus for this project.

## *Finding #4*

**Students at schools with known lead issues had greater pre-existing knowledge of lead sources and exposure prevention methods than students at schools without lead problems.**

In Rayong, a doctor came to Baan Khao Huay Mahad to give a speech about lead exposure prevention to the students at the school. He spoke about different factors of prevention and other relevant information. In Bangkok, there has been no lead specific education. Additional information and awareness has been stressed to these students through teachers and parents in order to keep them safe. Because of this background, it is safe to say that students in Rayong had a stronger knowledge regarding sources of lead and prevention methods from lead.

As mentioned previously, a survey question regarding lead sources was asked to students in both Bangkok and Rayong. Figure 15 shows differences in strength of prior knowledge from one site to another.

## Lead Source Prior Knowledge

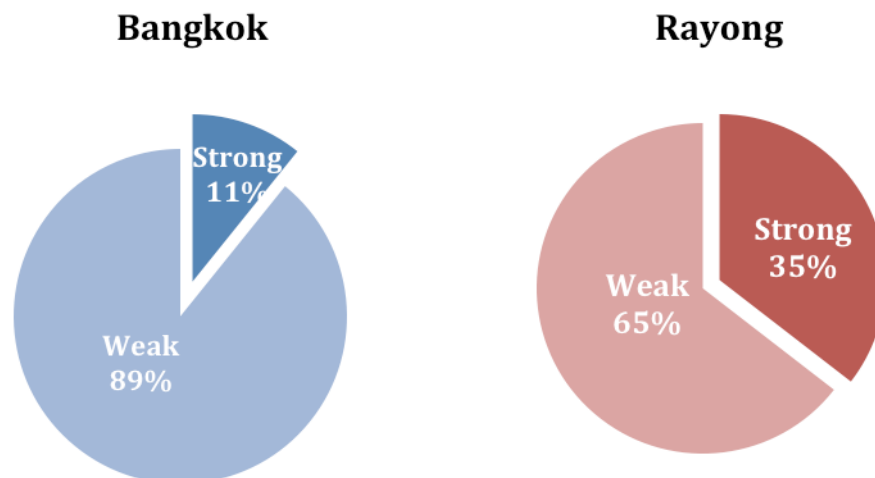


Figure 15: Lead source prior knowledge between schools

Clearly, there was stronger knowledge in Rayong than in Bangkok. 24% more students had strong knowledge about lead sources than in Bangkok. A teacher at the school in Bangkok said, “So little of them might know [the sources of lead] but then those I mentioned might know about the chemicals in the wrong definition. They might know only the basic that the chemical is dangerous.” 9 out of 10 students could only recognize 1-2 sources of lead, a number that needed great improvement.

Educating students about steps that may be taken to avoid lead exposure was another subject that was stressed in the program. This question was similar to the lead source question in that there were four correct answers and knowledge was deemed strong or weak based upon the number of options selected. The results of pre-survey data collection are shown in Figure 16. This figure is consistent with this finding. In Rayong, 18% more students had strong knowledge of lead exposure prevention methods than students in Bangkok. 14% of students knew at least 3 answers in Bangkok but 32% knew this many in Rayong.

## Exposure Prevention Method Prior Knowledge

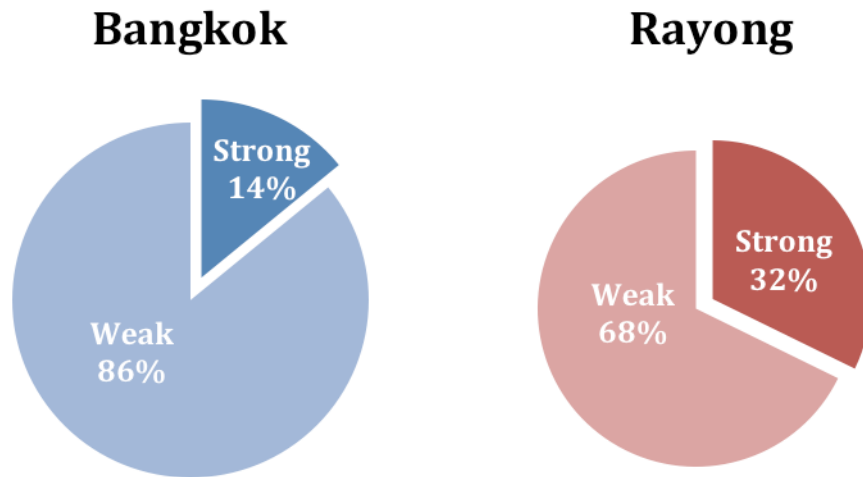


Figure 16: Exposure prevention method prior knowledge between schools

This finding is most likely due to the education that has been going on in Rayong to inform students about their current lead exposure issues. The students have been taught this information before, so they have more previous knowledge. Additional factors may include what is taught in science and health class or what information parents have provided to students.

### *Finding #5*

#### **This program effectively educated students about the sources of lead.**

When creating this program, informing students about where lead may be found was a major goal. If children don't know where lead comes from, they are unable to protect themselves. In Bangkok, the sources of lead that were focused on were playgrounds, dirt, air and tap water. Due to sponsor encouragement, several changes to the wording of these sources were made while re-designing for Rayong. "Playgrounds" was changed to "Painted toys and playgrounds", "Dirt" and "Air" were

combined into one answer, and “Colorful food with dyes” was added. The results of pre and post surveys are shown in Figure 17.

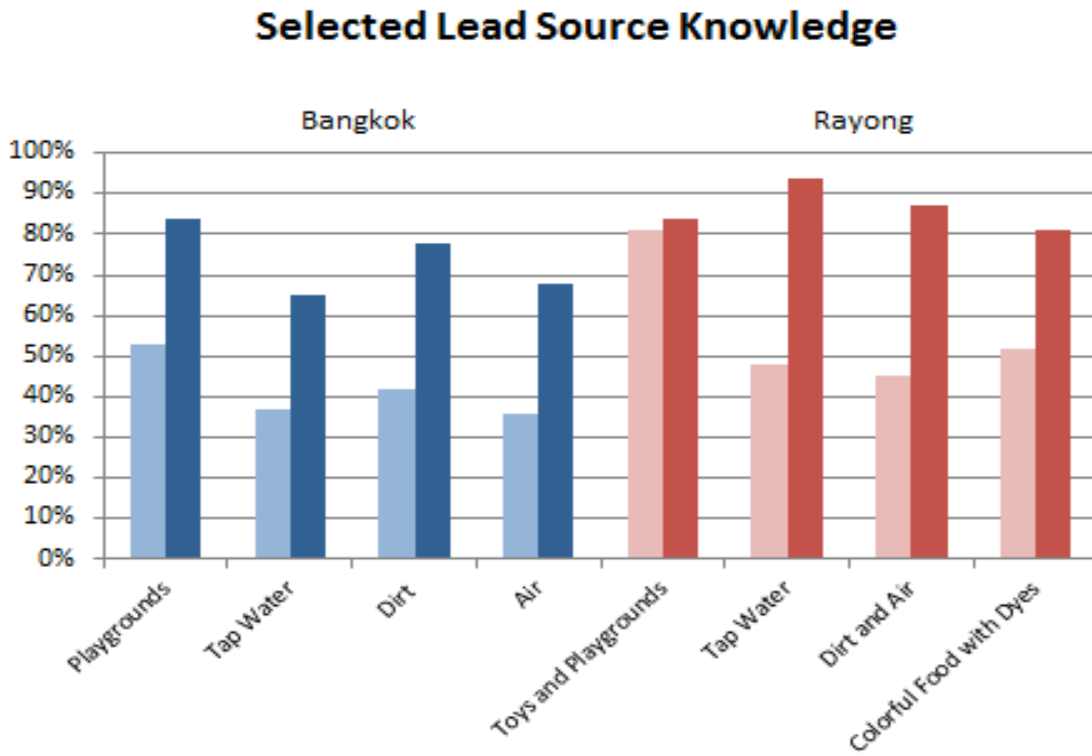


Figure 17: Lead source knowledge gain

This graph clearly shows that students learned about the sources of lead. In both Bangkok and Rayong, the percent of students able to recognize each source of lead increased. The only source to be recognized by more than 55% of students on the pre-survey was “Toys and playgrounds.” Following implementation in Bangkok, each source was recognized by at least 60% of students. After re-designing for the Rayong trial, each source was recognized by at least 80% of students. Not only does this graph show acceptable increases on individual sources, but it also displays that program revisions were effective.



Figure 18: Strength of knowledge about sources of lead

Figure 18 references the strong and weak knowledge discussed in Finding #4. This is a summary of all students tested on lead sources and their knowledge gain in Rayong and Bangkok. The lines representing the weak knowledge are dashed and light while the lines representing strong knowledge are full and dark. In both tests, the percent of students with weak knowledge greatly decreased, reduced by nearly 50%. Naturally, this decrease in weak knowledge warrants an increase in strong knowledge, resulting in 62% in Bangkok and 82% in Rayong. This 20% difference reflects effective program changes and revisions.

#### *Finding #6*

**This program effectively educated students about lead exposure prevention methods.**

In the creation of this educational program, informing students about how to prevent exposure was a main goal. After informing students where lead may be found, the next step was to educate them about preventative measures to avoid the negative effects of exposure.



Figure 19 shows the percentage of students that recognize a specific exposure prevention method. In both schools, the percentage of students who recognized each prevention method increased. The most dramatic increase was in Bangkok. 60% more students recognized drinking milk as a prevention method after the lesson. The only category that had a small gain was hand washing in Rayong, which was only recognized by one additional student after the lesson. That being said, the overall percent of students that knew it as an exposure prevention method was 92%. From Bangkok to Rayong, the only category that decreased was not putting toys in the mouth. It was recognized on post surveys by nearly 15% less students.

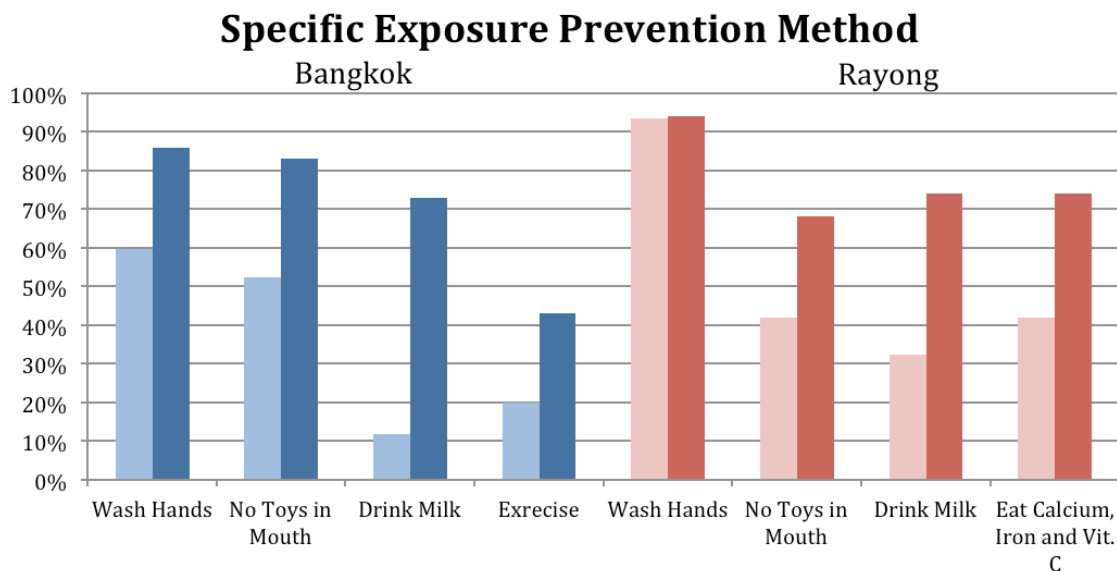


Figure 19: Exposure prevention method knowledge

It can conclusively be stated that students learned through participation in the educational program. Each method of exposure prevention was recognized by a higher percent of students following the lesson. Another aspect to take into account is strength of knowledge. In Figure 20, strong knowledge increases are clearly shown. Both schools showed 25% increases in the students that recognize 3 or 4 methods. A 10% difference from Bangkok to Rayong indicates effective program changes.

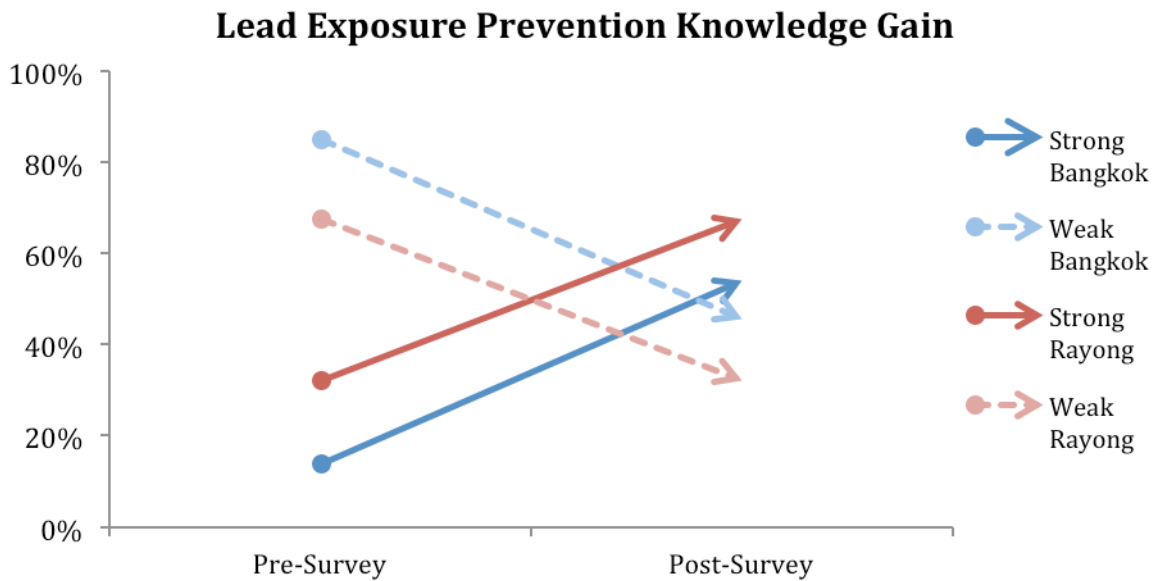


Figure 20: Student strength of knowledge about lead exposure prevention

#### *Finding #7*

**After our program, students feel empowered to protect themselves against lead.**

One of this program’s important goals was to not scare students but rather inform them of what they can do to stay safe. When designing the lesson plan, this was heavily taken into account. There was little mention of the serious effects of lead with emphasis placed on knowledge required to prevent lead exposure. A question about student feelings of safety was included on the post surveys in Bangkok. The question asked, “Do you feel safe from lead?” The results from this question are shown in Figure 21.

## Bangkok Post Survey Lead Results

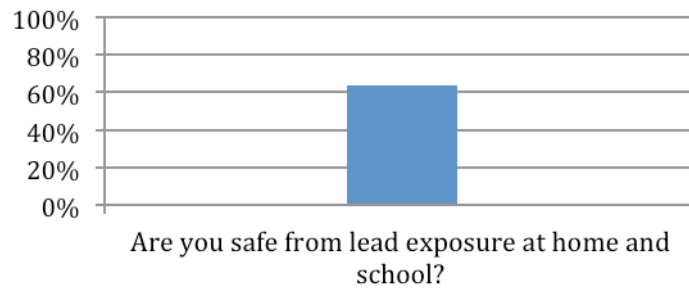


Figure 21: Student response to lead safety question

Only 65% of students reported feeling safe from lead. This was an unacceptable number for our project team. After reviewing the program and making changes, it was decided to revise the question to more accurately reflect this key goal. For Rayong, the question was changed to “Do you know how to protect yourself from lead?” Following this change, the results were undeniable. 31 out of 31 students in Rayong confirmed that they knew how to protect themselves from lead. The overall project goal of empowering students was confirmed by this result, is depicted in Figure 22.

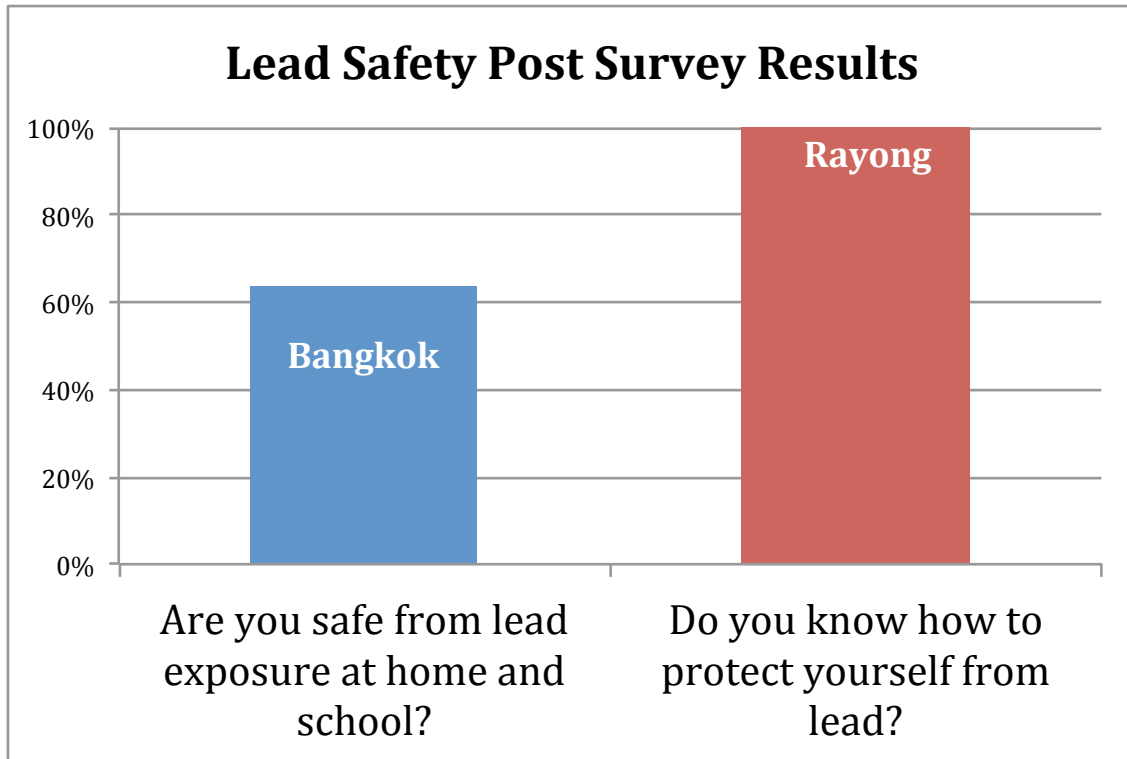


Figure 22: Result of lead safety questions in both schools

*Finding #8*

**Students enjoyed participating in this program.**

In Finding #1, it was determined that students learned best through participation, games and activities. Engaging students may sometimes be challenging, but through research and studies, the best methods were examined and included in program development. Another large factor in this creation was making these games and activities enjoyable. Engaging students is much easier if they are having fun while learning. A positive atmosphere allows learning about these dangerous materials less intimidating.

While observing the lessons, it was very obvious that students were having fun. They were excited, active and ready to learn. They contributed positively and asked questions. During gameplay, the students were competitive and focused while also enthusiastic at times. Statistical evidence of these comments is presented in Figure 23. 205 out of 206 students had fun during the lesson.

## Students That Had Fun

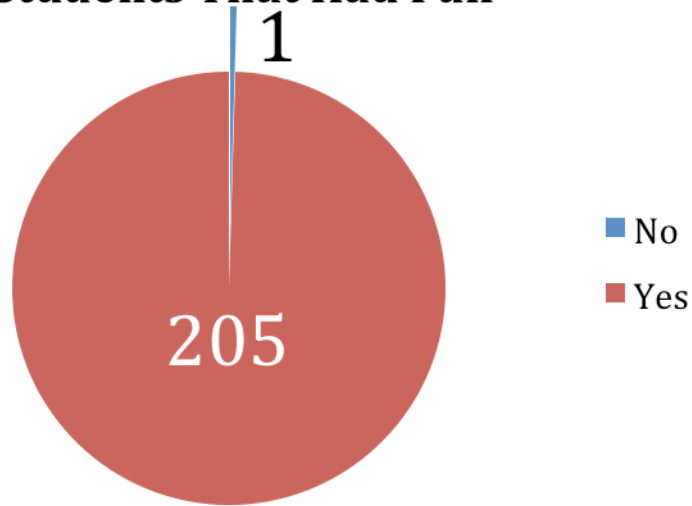


Figure 23: Student enjoyment results

It is safe to say that this level of enjoyment was a factor in the strong results discovered in the previous findings. With more children having fun during this program, it is easier to educate and inform them. Teachers also believed that the students enjoyed the activity and one in particular said, “The students understood everything, they had fun and the information is very interesting.” All of the other teachers agreed with her. Another stated, “I think they all had fun today, I can see it from their eyes...” Additionally, viewing the informative videos on the project website shows students participating and enjoying this fun activity.

## Chapter 5: Discussion and Conclusions

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This chapter will present our recommendations on educating school communities in Thailand about lead exposure and prevention. Our team has developed final recommendations for our sponsor, Thai government agencies, and other parties we found to have involvement in the subject matter. These recommendations were developed through the findings presented in the previous chapter. The schools studied were very different in environment, size, background and location. Because of the program's success in these different settings, we feel that the results are applicable to the entire country. These recommendations will benefit not only the school communities in Thailand, but also the general public regarding lead exposure.

We will also discuss the limitations of our program that can be addressed by future research and evaluation.

### *5.1: Recommendations about Design and Implementation of Lead Education*

**We strongly recommend that an educational program to inform school communities about the sources and dangers of lead exposure and how to prevent or mitigate its impacts be implemented throughout Thailand.**

Lead in school communities is an issue across Thailand. Our literature review, background research, and personal experiences at schools have confirmed this. We investigated health records from one school in Rayong, where multiple students exhibited high levels of lead in their bloodstream. These students are unaware of preventative measures that they can take to reduce their risk of lead poisoning.

For this reason, we are strongly recommending that school communities in Thailand be provided with an educational program to inform students, faculty, and parents about the sources and dangers of lead exposure and how to prevent or mitigate its impacts. In our results, Finding #3 states that students had substantial

prior knowledge regarding the general consequences of lead but lacked awareness about lead sources and exposure prevention methods. Most students know what lead is and that lead can make you sick, but they don't know how they can prevent lead exposure to keep themselves healthy. This is a finding that needs to be addressed. Every student in Thailand should have the knowledge of how to protect themselves from dangerous chemicals in the environment.

Finding #4 states that students at schools with known lead issues had greater prior knowledge of lead sources and exposure prevention methods than students at schools without lead related problems. Although a school does not have issues surrounding their school about lead exposure, the students should still be aware of how to protect themselves from this dangerous chemical in the environment. If this education is encouraged in areas without current issues, cases of exposure will be greatly limited. Optimally, all students will be aware of lead, not because they are sick, but rather because they have been provided adequate education.

A limitation that may pose a problem for this recommendation is the willingness of teachers to implement an educational program about lead if there is not a lead issue at their school. Finding #2 states that the lack of knowledge about lead exposure is associated with the lowered willingness of teachers to educate their students about lead. We found that the teachers at the school that did not have a known lead issue were less willing to teach our lesson plans. The administration was very helpful in encouraging our lesson plan, but the teachers were not excited to give up class time to teach the material. This limitation can be addressed by constant encouragement by governmental agencies and school administrations to implement a program so that the students in Thailand will gain this important knowledge about the chemical lead.

**We strongly recommend that the School of Global Studies send information about our educational program to every school in Rayong, Thailand. Success in Rayong would result in a recommendation to send information about our educational program to every school in Thailand.**

Along with recommending that schools in Thailand implement an educational program about lead exposure and prevention, we would also like to strongly recommend that our sponsor, the School of Global Studies at Thammasat University, send information about our program to every school in Rayong, Thailand. With success in Rayong, we would also recommend our program to be sent to every school in Thailand to teach students across the country about lead, its effects, and what they can do to keep themselves safe from this dangerous chemical.

Finding #1 supports that we identified how to best educate students about lead exposure. This background knowledge provided the fundamental basis for this lead education program.

We are confident that the activities within our educational program are effective in providing knowledge to school communities. Finding #5 states that our educational program effectively educated students about the sources of lead. It can be seen in the survey results that the students we implemented our program with gained knowledge about the sources of lead. This goes hand in hand with Finding #6, which states that our educational program effectively educated students about lead exposure prevention methods. Our results showed that the students gained strong knowledge about steps they can take to keep themselves safe from lead after our program. These two findings justify that our program would help students across Thailand protect themselves from lead.

Finally, Finding #7 and Finding #8 defend our recommendation of educating students across Thailand with our program, Lead Free Community. Finding #7 states that after our program, the students felt empowered to protect themselves against lead. We did not want to scare the students, but truly empower them in the fight against lead poisoning, and this finding shows that we have achieved our goal. Finding #8 states that students enjoyed participating in the program. If the students can learn crucial information about the chemical lead and still have fun, then we feel that we have created a program that should be implemented across the country.

Because we implemented our educational program at only two schools in Thailand, this sample size poses a limitation to this recommendation. Despite the



diversity between the two schools, a higher number of implementations may have resulted in a stronger program. This limitation can be addressed with a following recommendation that includes future research and improvements to our educational program.

**We strongly recommend that the Ministry of Public Health in Thailand provide more information to the public about paint containing lead, resources for lead paint removal, and lead exposure on toys and playgrounds.**

Although this recommendation does not relate to our health risk education program for schools in Thailand, we feel that it is very necessary for the Ministry of Public Health in Thailand to provide more information to the general public about lead paint and lead paint removal. In our research and implementation, we have found that many parties in Thailand do not have an understanding of lead paint and the damaging effects it can have on the human body. We feel that the lack of regulations on lead paint may result in major use of this dangerous product. If the Ministry of Public Health focuses its efforts on spreading information about lead paint and possible lead-containing objects, like toys and playgrounds, the public will be more aware of exposure.

**We recommend that the School of Global Studies offer information to administrators, parents, and donors of school communities across Thailand about safe donation practices.**

Schools receive donations in various ways, including parent donations, third-party donors, and governmental donations. We did not investigate this idea in our study but we do feel that it is of concern. Donations could be dangerous because of the lack of regulations regarding paint containing lead and the regular use of this paint on toys and playgrounds. We recommend that our sponsor investigate this topic more thoroughly and determine best practices that the schools may use to ensure that all donations are safe for the students and the school community.

## *5.2: Sustainability and Feasibility of Lead Educational Programs*

Because the entire educational program, including all final deliverables, is available online, it is possible for any school to easily access our materials and implement our program. The lesson plans are comprehensive and provide everything necessary, while also allowing a wide degree of freedom in the way the lesson is run. Therefore, based on teacher preference, the information can be disseminated to the students, parents, and school faculty in many ways. The lessons were designed to be easy for a teacher to follow and execute. As long as an interested school has access to the Internet and a printer, the program can be implemented.

**We strongly recommend that future researchers continue our program and create a Survey Result Database to track the implementation and success of our program in the future.**

We would also like to make a recommendation for future researchers and other teams to continue work on our program. This recommendation includes the design and creation of a Survey Result Database. This would be a simple to use, web-based database for schools that implement our program to submit their Student Survey results. These results would be helpful for future researchers to keep track of what schools implement our program, how their students perform, and what types of revisions can be made to improve the program. Because we were only able to implement and evaluate results at two schools during our time with this project, we did not have the time to continue analysis to ensure a most effective final product. Always collecting results and feedback about our educational program would continuously permit improvements, so we recommend that future researchers continue improving our program and collecting survey results from schools across Thailand.

**We strongly recommend that the Ministry of Public Health in Thailand hosts our original website, Lead Free Community, improves its content, and makes the information and educational program more accessible to schools and the public in Thailand.**

Not only do we recommend our sponsor to encourage the use of our program, but we are also recommending that a governmental agency become involved. We would like the Ministry of Public Health in Thailand to host our website and improve its accessibility across Thailand. We also recommend that they assist the School of Global Studies at Thammasat University in the promotion of our program to be used in schools across the country. By integrating the website and improving its availability, we feel that more schools in Thailand will implement our educational program.

Finally, our educational program was designed to be very feasible. This is a result of our project team's limited budget during the design and creation process. All materials can be printed at a low-cost. All activity material is also inexpensive including standard paper, string, and poster paper. Also, it is noted that the activity materials can be re-used in consecutive classes and over a few years, depending on wear. This will contribute to the feasibility of our lessons. We are very pleased to provide an all-inclusive and feasible educational program, accessible to schools throughout Thailand.

### *5.3: Final Remarks*

This project addressed the issue of the high prevalence of lead exposure among school children in Thailand. Lead is present in the environment naturally, however its use in industry has caused pollution. There are some regulations on the emissions of lead into the environment, however its low cost and use in products, such as paint, is controlled by unenforced guidelines. Lead dust from lead paint can pollute air and as it settles, it contributes to the contamination of water and soil. Lead can be introduced into the body through ingestion, inhalation and through the skin. This may cause serious negative health effects. Children are more susceptible

because their bodies uptake more lead, which is detrimental during growth and development. Studies have shown that elementary school students in Rayong have dangerous levels of lead in their bodies (Sarnsamak, 2012). To address this issue, the School of Global Studies at Thammasat University asked us to design a creative educational program to inform students, their parents, and school faculty about the sources and effects of lead, as well as how to prevent exposure.

We created a comprehensive educational program that effectively informs school communities about lead exposure and what to do about it. A literature review of lead exposure effects, risk communication, past programs and environmental policy was conducted to determine what information we should get across and how. We utilized participatory action research to incorporate the school communities' ideas and feedback to create an effective program. By doing trials at two schools, we were able to continually alter, test, and evaluate our program to ensure its success.

The final deliverables created provide helpful information to students, parents, teachers, and school administrators to ensure that they can protect themselves from lead exposure. Though it is important to show the school community the dangers of lead, we chose to empower the students, not scare them. Although continual lead exposure can be detrimental to one's health, there are steps people can take in their daily lives to minimize exposure. By recognizing the sources and practicing healthy habits, people can keep themselves safe. We hope that the information we provided will empower the target groups to stay healthy, as well as inspire them to take steps towards living in a lead-free community.

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# Appendix

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## Field Forms

### Teacher Pre-Interviews

Below you will find a blank copy of our Teacher Pre-Interviews, as well as completed Teacher Pre-Interviews by various teachers from Wat Pathumwanaram (Bangkok, Thailand). These interviews were performed at the beginning of our project to gain an understanding for our program design.

*Teacher Pre-Interview (Blank Copy)*

### **Interview Guide for Teachers Before Design**

Name:

Grade of Students Teaching:

Number of Students in Class:

Our goal is to find creative and effective ways to help this community learn about lead exposure and its effects as well as how to prevent further exposure. We would like your help establishing a knowledge base as well as sharing your expertise about what works best for this community. The following questions will help us determine how much the community knows about lead exposure so we know where to start. In addition, we would appreciate your input about education and what will be a most effective plan for you and your students.

#### General Information about normal lesson hours

For one lesson, how long are your students generally pay attention to the lesson?

What are most effective forms of a lesson plan that you look for when preparing to teach your students (Materials, Instructions, etc.) ?

What types of lesson plans/strategies do you feel are most effective?

Craft projects

Games

Lecture

Group work

Quizzes

Other

In the classroom, what strategies you use to keep the students enthusiasm?

Information for activities and materials preparation

To your knowledge, what do your students know about chemicals in the environment and if there are any health risks associated with them? If yes, what are they told about protecting themselves?

Have you seen your students do any of the following?

- Putting their hands in their mouths?
- Crawling on floor/ground?
- Putting toys in their mouths?
- Washing their hands before meals?

Will your students be able to answer the survey questions we prepared for them? What changes do you recommend?

What is the optimal amount of class time you think this program should take between 60 minutes in one day or 30 minutes for 2 days?

If you were designing this program, how would you tell your students how to protect themselves from lead?

Interaction with students' parents

How often do you contact students' parents?

How do you usually contact with the parents?

- Email
- Parent-teacher conferences
- Meetings
- Sending notes home to parents
- Phone calls
- Other\_\_\_\_\_

How cooperative are the parents to the school activities?

How much do you think the parents will be interested in our lead poisoning project?

Other comments?

### **Interview Guide for Teachers before design**

Name: A. Sumontha Eakaikum

Grade of Students Teaching: Grade 1

Number of Students in Class: 40

Our goal is to find creative and effective ways to help this community learn about lead exposure and its effects as well as how to prevent further exposure. We would like your help establishing a knowledge base as well as sharing your expertise about what works best for this community. The following questions will help us determine how much the community knows about lead exposure so we know where to start. In addition, we would appreciate your input about education and what will be a most effective plan for you and your students.

#### **General Information about normal lesson hours**

For one lesson, how long are your students generally pay attention to the lesson?

- For the young kids, they can focus for lecture for about 30 minutes. After that the activities are necessary for their attention. The activities I mentioned means like the activities that the kids are actually doing something productive. For me, I am a Thai language teacher, so I teach them lecture about how to read first for 30 minutes and then after that, I will have them do the writing part.

What are most effective forms of a lesson plan that you look for when preparing to teach your students (Materials, Instructions, etc.) ?

- The multimedia can be used but it doesn't really effective to the young kids. For example like the Tablet that the government gives to the school, the kids are excited at first, then later on they got bored of it. It mostly depends on the details of the lesson.

What types of lesson plans/strategies do you feel are most effective?

Craft projects

Games

Lecture

Group work

Quizzes

Other

- Craft project or art work is the most effective, then games, group work, lecture, and quizzes. My suggestion is something containing cartoon figures and a lot of pictures.

In the classroom, what strategies you use to keep the students enthusiasm?

- Normally, the young kids are very enthusiastic. They all will answer the questions without hesitating. They like to be complimented, the students with compliment always feel that they are the shine in the classroom and some prizes will encourage them a little more. The prizes can be either dolls or the stationery kit with cartoon screen on it.

### Information for activities and materials preparation

To your knowledge, what do your students know about chemicals in the environment and if there are any health risks associated with them? If yes, what are they told about protecting themselves?

- So little of them might know but then those I mentioned might know about the chemicals in the wrong definition. They might know only the basic that the chemical is dangerous. About the protection, they know that washing their hands are good but they do not know the right way of washing such that the five fingers need to be washed thoroughly here and there. They might not know that the way they wash their hands are clean or not. And also, they don't really wash their hands regularly if there is no one looking after them.

Have you seen your students do any of the following?

Putting their hands in their mouths?

Crawling on floor/ground?

Putting toys in their mouths?

Washing their hands before meals?

- They never put their hands in their mouth, not that I can notice. But crawling and playing on the floor is quite often. For the hand washing, the school doesn't set off the rules for it, it's just the practice that I assume everyone should know already. But for the young kids, even if they know but they wouldn't do it.

Will your students be able to answer the survey questions we prepared for them?

What changes do you recommend?

- I have the concern about the word 'lead'. They might not have heard of it but if you explain to them first and let them answer afterward, they might be able to do it. But if it is the pre-test without any knowledge, then I think the kids can guess but they are not likely going to get it correctly for number 3. I think all of this is okay. The hard ones for them might be number 3 and number 5 because they will have to take a guess on these two.

What is the optimal amount of class time you think this program should take between 60 minutes in one day or 30 minutes for 2 days?

- I think the lecture for 30 minutes and the activities afterward for another 30 minutes is better.

If you were designing this program, how would you tell your students how to protect themselves from lead?

- I would create the story book with a lot of pictures, gather them up and then read it out loud to them. The first graders like the story book very much. It will be great if they all have one book for their own but if not they can just listen to me. For different genders, they have different preferences but I requested the story book with cute cartoon figures.

### Interaction with students' parents

How often do you contact students' parents?

- I don't normally contact them. I do when the kids have trouble at school and it needs to be reported to the parents. The parents themselves don't really come to see me either. The school has the teacher-parents meeting once per semester. But I don't really talk to them if they don't have any trouble.

How do you usually contact with the parents?

Other \_\_\_\_\_

- If needed, the school will offer the official letter with the information that is needed to be transferred. I don't usually contact them personally. The letters will be given to me and I will have to read and clarify them to the students to make sure that they understand the content. And then the students will take the letters to their parents. The parents will have to sign the fill form at the bottom of the page that they already received the letters and has understood the contents.

How cooperative are the parents to the school activities?

- They are very cooperative. But some of the parents won't have much time to do so because they go to work early and also get off from it pretty late. Each families have different financial background. I will say my room has 40 students, I will always get the returned fill form up to 30 -35 students every time, only a few of them wouldn't return it. If the content in the letter is very important, I will need to call their parents for the returned form. But if it is not an important information, I wouldn't do anything.

How much do you think the parents will be interested in our lead poisoning project?

- I think they might be interested in it. I cannot really answer because I haven't seen the materials yet. I do not know exactly how the information included in the pamphlet will be like.

Other comments?

- I would suggest the story book, have figures and some prizes for them would be enough.

### **Interview Guide for Teachers before design**

Name: A. Tunyanun Punsed

Grade of Students Teaching: Grade 2

Number of Students in Class: 40

Our goal is to find creative and effective ways to help this community learn about lead exposure and its effects as well as how to prevent further exposure. We would like your help establishing a knowledge base as well as sharing your expertise about what works best for this community. The following questions will help us determine how much the community knows about lead exposure so we know where to start. In addition, we would appreciate your input about education and what will be a most effective plan for you and your students.

#### General Information about normal lesson hours

For one lesson, how long are your students generally pay attention to the lesson?

- Not more than 10-15 minutes. After this 15 minutes, the students start to talk to each other and ignore the lesson.

Then how do you get them back on focus?

- Sometimes, when the kids start to talk or ignore the class, I would have some punishment and they will be scared but only for a short while. I will have to lure them that if you finish your work fast, I will let you play games. So they will focus on their work until finish because they know that they will have games afterward. They like it very much when I announce that they can play games as soon as they finish with the assignments. I teach about the hygienic practice so the lecture is pretty boring. I always tell them that if you finish the work then I will take them down to the computer lab and they can play games or paint in the computer.

Then if it's the academic game, would they be interested? For example Soi dao game with the questions inside and the students would have to answer to be rewarded and Jeopardy games.

- I think they will. They would like it if there are awards.

What are most effective forms of a lesson plan that you look for when preparing to teach your students (Materials, Instructions, etc.)?

- I would use the games as the reward if they finish their works fast.

What types of lesson plans/strategies do you feel are most effective?

Craft projects  
Games  
Lecture  
Group work  
Quizzes

Other

- Most effective would be games, craft projects, group work, quizzes, and then the least would be lecture.

In the classroom, what strategies you use to keep the students enthusiasm?

- Motivation would be a good one. The prizes and reward that they know they will get. They like dolls and robots.

#### Information for activities and materials preparation

To your knowledge, what do your students know about chemicals in the environment and if there are any health risks associated with them? If yes, what are they told about protecting themselves?

- They never know about the chemicals at all. They only know so little, the better way would be to ask the science teachers. I did teach them that before eating, they should wash their hands thoroughly and in a correct way. The science subject would teach about the chemicals more than my subject. We don't have homeroom teacher, so most information will be delivered in the morning announcement after the national anthem. Sometimes, there are also the group of people from the health organization who comes and give some information to the students as well. So if you give me information about the lead poisoning to me or the head of students, we could just announce in the morning so that everyone in the school will be hearing about it too.

Have you seen your students do any of the following?

Putting their hands in their mouths?

Crawling on floor/ground?

Putting toys in their mouths?

Washing their hands before meals?

- I always see that happened with my students. Some of my students put their fingers into their mouths when they are stressful in class. Putting toys, erasers, pencils in their mouth. I used to tell them that putting those into their mouth is dangerous. But the reason why they still do it is because the bad result didn't occur right away. They didn't see that these actions can make them sick. So they always put things in their mouth and chew. Some of the erasers have good smell, so I guess that they like the smell so they would like to taste it too. I believe that there is chemicals in it. Washing before meals is not really a habit of the students. Some of them do and some of them don't. It is not the school rules so the students don't feel that they will have to do it unless there is someone telling them to. The canteen at our school is pretty clean though. When the teachers are around, they will use the utensils but I don't know when they spill the food on the table they might use their hands. We cannot control that. They always crawl and roll on the floor. I see it so often.

*(but the school has the policy that the students needs to take off their shoes?)*

yes, but then some of the students might wear the same socks repeatedly.



That would make the floor dirty as well. (*May I ask about the financial background of the students families?*) Mostly they are poor, there are little of the middle class and upper class roughly around 0.01 percent of all. Since our school is the local school, so the materials in school are free. The uniform, the books, the food, everything was provided without a charge. They would want to have dolls and robots more than anything to be their own. Other than that would be the stationery, but not the cheap ones. Those which are provided by the government are cheap so they wouldn't care much about it. But in case of the dolls and robots, the students would take care of that possessions more.

Will your students be able to answer the survey questions we prepared for them?  
What changes do you recommend?

- I think they are good. The word 'chemical' and 'lead' might not be easy for the students. I think you should write a rough explanation about these two words before you get into the questions. They might be able to understand better.

What is the optimal amount of class time you think this program should take?

- I think the lecture for 30 minutes is kind of less. One hour would be good because at the first 30 minutes sometimes you can't get them in controlled yet. The actual lesson will start around 15 minutes after the school hour starts. And if we are being involved, they wouldn't adapt too fast. They will be talking and trying to get to know you. It is hard to get them in control in a short period of time. I would suggest that you come in, introduce yourselves, then the instructions, then we give them lecture.

If you were designing this program, how would you tell your students how to protect themselves from lead?

- I think I will ask them first with something like 'do you know what this is and if you know, how would you protect yourselves from it?' I will let them answer to me first, think by themselves first without telling that their answers are right or wrong. I would pick up the materials that the students own or what the students see in their everyday life such as pencil and eraser and ask them if they think these stuff contain the chemicals. Later on, I will tell them information and the right answer later on. This way they will have fun in answering with their own opinion. They like to share and to say that they know about the thing that I am asking. (*What do you think about announcing these information in the morning announcement?*) Very good, you can give it to me on Thursday or the students can be the one talking too. (*Do you have any comments about the stickers we made?*) For the girls I suggested the Barbie instead of girl super hero. For the boys, it is good enough. I only concerned about the girls.

## Interaction with students' parents

How often do you contact students' parents?

- I talk to them almost everyday, very often. Some of them come and talk to me. I always walk around near the school entrance where the parents would come and wait for their kids at the benches, so I would interact with them pretty often. I talk to them very often, so I could know about the students. Some of them are different in school and at home. We have to exchange that information with the parents too. (*About the pamphlet, would the students deliver them to their parents?*) Yes they will, because they will have to return the form that parents know what the school wanted the parent to be aware of.

How do you usually contact with the parents?

Email

Parent-teacher conferences

Meetings

Sending notes home to parents

Phone calls

Other \_\_\_\_\_

- Parents-teachers conference and letters to the parents with the return form.

Other comments?

I would suggest the information with the references to me. Because sometimes the information that I announced have some feedback from the parents. Some of the parents bring the references which oppose what I announced to the students. So it would be good if there are references in your information delivery.

### **Interview Guide for Teachers before design**

Name: A. Jiratchaya Chobtam  
Grade of Students Teaching: Grade 3  
Number of Students in Class: 40

Our goal is to find creative and effective ways to help this community learn about lead exposure and its effects as well as how to prevent further exposure. We would like your help establishing a knowledge base as well as sharing your expertise about what works best for this community. The following questions will help us determine how much the community knows about lead exposure so we know where to start. In addition, we would appreciate your input about education and what will be a most effective plan for you and your students.

#### General Information about normal lesson hours

For one lesson, how long are your students generally pay attention to the lesson?

- I cannot tell in terms of the time, it depends on the way of teaching at that moment. For my period, if there is the activities in which they could do some crafting or painting, they can stay focus in a pretty long run and being very active. But something like lectures or telling stories about the famous people in the past, they will get bored pretty easily. Short lecture is preferred.

Then how do you get them back on focus?

- I give them extra points on that assignments, give them the star shape stickers so they can show their friends. That will make other students more enthusiastic because they want to have extra points too. They really like stickers. I always tell them that if the students can finish the work today within the working period, they will get my signature and I will add extra points. For dolls and toys, they would still be interested, but I think mostly they will like to have stickers with the famous cartoon (Ben 10).

What are most effective forms of a lesson plan that you look for when preparing to teach your students (Materials, Instructions, etc.)?

- They are more interested in the working activities. For example, I will show them the prototype of the craft, and they would like to do it on their own. So I think the best method would be the thing that they can actually do it themselves and have that as their own possession. *(We are doing the short stories about lead poisoning, do you think the students will be interested?)* I think if they have to read on their own with a lot of words, they wouldn't be interested. So I think if the story book contains the mascot of lead so that the kids remember clearly about lead. Then they will be recognized about the dangers of it. For the PowerPoint slide show, if there is interesting information with some funny storyline and animation will be good, not too

academic. Because at this level the lecture wouldn't be comfortable for the kids. They won't pay much attention to it. If there are cartoon and animations, it would be better for the kids to recognize.

What types of lesson plans/strategies do you feel are most effective?

Craft projects

Games

Lecture

Group work

Quizzes

Other

- Most effective would be games, group work comes second as in 4 students in a group, more than this some other students won't be working and so some of the student will take more roles than the others. Then the craft work or art painting, quizzes, and then lecture is the last.

In the classroom, what strategies you use to keep the students enthusiasm?

- Compliment and prizes. I give them compliment in front of other students so that they feel that they are in the main focus of the room. Then everyone wants to get compliments from teachers as well. For those who cannot accomplish the work won't be punished but they will be told to try a little bit harder. The prize will have to be enough for the students in the group. It cannot be given as one as a group.

#### Information for activities and materials preparation

To your knowledge, what do your students know about chemicals in the environment and if there are any health risks associated with them? If yes, what are they told about protecting themselves?

- Mostly, I think the information about lead is taught in the middle school level. For this young students, I only told them that they should wash their hands before eating but I didn't state that it's because of the lead poisoning. I only mention that it is for cleanliness and good hygiene. They followed what I said, but it is not really 100 percent. Some of the students do it regularly but some just don't. They can remember it but sometimes they just ignore. I guided them the good way to keep their hygiene, but it depends on them whether they will do it or not. No one was in charge of checking on them. *(what about we set up the checking control for the students, would that help?)* If there is the person who takes care of it, then I think they will do it. You will have to do it for them as example. But once the person is gone, some of them might ignore that again.

Have you seen your students do any of the following?

Putting their hands in their mouths?

Crawling on floor/ground?

Putting toys in their mouths?

Washing their hands before meals?

- This is so obvious, you can observe during the lunch time in the football field. Some of the students own the building blocks (LEGO'S-liked) and they put those stuff in their mouth. Some of them picked up the snacks which they out on the floor into their mouth.

Will your students be able to answer the survey questions we prepared for them?

What changes do you recommend?

- You should explain the definition of 'chemical' first in the question. The kids learn about the environment, living things and non-living things but not specifically about the chemicals. So explain roughly about chemical then go into the questions later on. Some of them might know, but to be safe, it is better if you explain it first because some of the chemicals are good for the bodies, not all of them are bad. But I think if this means to be the pre-test then it is okay. All of them I think the students can guess and try to make themselves right. I assume that they might know briefly that lead is bad for health. But they wouldn't know as deep as how to find them or what health effects lead could cause. (*what about the lesson plan that we try to input the information into it ?*) I think it will be okay if the director agrees to have this information permanently into the lesson plan, so the students next year can learn this also.

What is the optimal amount of class time you think this program should take?

- My class normally lasts for 2 hours. I think your activities can last or 60 minutes. I mean it can be done within one day. If the activities run longer than 60 minutes, I still have another hour. So it doesn't matter at all. In one day would be just fine. This activity can just take one day of my class off for one hour. I can make up my own lesson in another hour.

If you were designing this program, how would you tell your students how to protect themselves from lead?

- If it was me, like I said I would do the mascot. If possible, I will make the mascot dress and make them wear it. So they can remember the visual of lead. Then, I would teach them about the information you gave. I might use the slides that have animations with dynamic cartoon.

### Interaction with students' parents

How often do you contact students' parents?

- Not very often though I will say once a week, normally I will meet them at the school conference.

How do you usually contact with the parents?

Email

Parent-teacher conferences

Meetings

Sending notes home to parents

Phone calls

Other \_\_\_\_\_

- I have them in contact by phone calls sometimes.

How do you think the parents will be interested in our project? We have plan to give the pamphlet to the students and let them explain those they learned to their parents. What do you think?

- I think they will be interested. Once we give them the pamphlet, we have the official letters for them. And the students will have to return the forms to me. I think it will work if I have their parents write briefly about the pamphlet and sign the return form back to me.

Other comments?

- I think the stickers would work fine with 3<sup>rd</sup> graders. I would like to have the font size a little bit bigger. Put some pictures and important keywords in the lesson plans. Do not put a lot of words, the students wouldn't like it much.

### **Interview Guide for Teachers before design**

Name: A. Sarunya Pongmunjit  
Grade of Students Teaching: Grade 4  
Number of Students in Class: 40

Our goal is to find creative and effective ways to help this community learn about lead exposure and its effects as well as how to prevent further exposure. We would like your help establishing a knowledge base as well as sharing your expertise about what works best for this community. The following questions will help us determine how much the community knows about lead exposure so we know where to start. In addition, we would appreciate your input about education and what will be a most effective plan for you and your students.

#### General Information about normal lesson hours

For one lesson, how long are your students generally pay attention to the lesson?

- For my students, I will say around 20-30 minutes. After that, they talk all the time with their friends and ignore the lessons.

What are most effective forms of a lesson plan that you look for when preparing to teach your students (Materials, Instructions, etc.)?

- I think the PowerPoint presentation is effective. Some multimedia like short movies or the clip with useful information in it.

What types of lesson plans/strategies do you feel are most effective?

Craft projects  
Games  
Lecture  
Group work  
Quizzes  
Other

- Most effective ones will be the games, then the craft work and art work. The group work, quizzes, and lectures I would have them in the same priority. Some of the kids are not participating in the activities.

In the classroom, what strategies you use to keep the students enthusiasm?

- They will be willing to participate if there is the games they can enjoy afterwards. Some of the rewards and prizes would also motivate them as well. I suggested they like the stickers.

### Information for activities and materials preparation

To your knowledge, what do your students know about chemicals in the environment and if there are any health risks associated with them? If yes, what are they told about protecting themselves?

- They don't know much about the chemicals. They have been taught generally about health; for example, about the general ways to keep themselves clean.

Have you seen your students do any of the following?

Putting their hands in their mouths?

Crawling on floor/ground?

Putting toys in their mouths?

Washing their hands before meals?

- Yes, I have seen them with their hands in their mouth, the toys as well. And they always crawl and play on the floor. Washing hands before eating, they don't really do that very often.

Will your students be able to answer the survey questions we prepared for them?

What changes do you recommend?

- Yes I think they can

What is the optimal amount of class time you think this program should take?

- I think it should take one hour. But it will be good to have the kids play a game before the lecture and teaching lesson. Then after the lesson, they can play another games as well.

If you were designing this program, how would you tell your students how to protect themselves from lead?

- I would use the pictures, some scary pictures because they won't be interested in the simple and plain pictures. For example, there used to be the campaign to reduce smoking habit and there are a lot of scary pictures on the human bodies. The students are scared of it and they won't do it. And also, the information can be announced in the school radio during school break times.

### Interaction with students' parents

How often do you contact students' parents?

- Normally once per semester through the teachers-parents conference.

How do you usually contact with the parents?

Email

Parent-teacher conferences

Meetings

Sending notes home to parents



Phone calls

Other \_\_\_\_\_

- I contact them in person during the parents-teachers conference. And also, sometimes we contact through phone calls. Not really often, unless the student is in trouble that we need to contact them. The school will offer the letters to the students to give to their parents.

How do you think the parents will be interested in our project? We have plan to give the pamphlet to the students and let them explain those they learned to their parents. What do you think?

- I think the parents would be interested in some level. They will be able to tell their parents about what they learned.

Other comments?

- I would suggest the PowerPoint presentation with animation or if without animation would be just fine, but not too much words. It can be some pictures and ask them if there is lead present in there. They can answer and participate before we tell them the right answer. The prizes can be dolls, stationery, and angry bird dolls. For the stickers, I think the design is pretty good. The students should like them. For the activities, I think the soi dao game is okay and the jeopardy is good. I also suggested that we teach the washing hands song in which there are 7 steps of how to clean their hands thoroughly. For the pre-test, I think they can have the multiple choices but for the post-test, I think I would have them write it instead. So they can explain the reasons for their answers. The short story can be done by the students themselves or it could be by me.

### **Interview Guide for Teachers before design**

Name: A. Jitpinan Ditpisitkul

Grade of Students Teaching: Grade 5

Number of Students in Class: 40

Our goal is to find creative and effective ways to help this community learn about lead exposure and its effects as well as how to prevent further exposure. We would like your help establishing a knowledge base as well as sharing your expertise about what works best for this community. The following questions will help us determine how much the community knows about lead exposure so we know where to start. In addition, we would appreciate your input about education and what will be a most effective plan for you and your students.

#### **General Information about normal lesson hours**

For one lesson, how long are your students generally pay attention to the lesson?

- In my opinion, it depends on the teacher. But for me, one hour they are still in focus because attractive method. I teach about reality and about things in their daily lives.

What are most effective forms of a lesson plan that you look for when preparing to teach your students (Materials, Instructions, etc.)?

- Some tape cassette, videos, DVD, some of the real prototype or the model of the lesson that is going to be presented in that lesson.

What types of lesson plans/strategies do you feel are most effective?

Craft projects

Games

Lecture

Group work

Quizzes

Other

- They will be interested in the games, then the rest can be at the same level of importance, The art work or craft work can be the activities in which the students can actually make up the model (from paper or boxes) or drawing. The group work can be the role play in which takes up about two hours. They will have to have their own scripts so they know information about the lesson that they are being role played. I provided them the script according to the information in the lesson plan. And then if the students can remember or adapt to say in their own word. Either way, the students will remember and understand the information given. If they are not willing to remember

the line, there can be a narrator. They are having fun in the same time. It can be considered as a game as well, there will be the audience watching them.

In the classroom, what strategies you use to keep the students enthusiasm?

- The teaching techniques in which I told you before about the role plays, using the media and fun activities.

#### Information for activities and materials preparation

To your knowledge, what do your students know about chemicals in the environment and if there are any health risks associated with them? If yes, what are they told about protecting themselves?

- Mostly, they will know it from the news in the television and science subject. They might know about some other chemical not only Lead. Some of the simple chemicals in the shampoo.

Have you seen your students do any of the following?

Putting their hands in their mouths?

Crawling on floor/ground?

Putting toys in their mouths?

Washing their hands before meals?

- The 5<sup>th</sup> graders are not really having the habits of putting hands and toys in the mouth anymore. They don't really wash hands either. They mostly sit and do activities on the ground but not really crawling and playing.

Will your students be able to answer the survey questions we prepared for them?

What changes do you recommend?

- Not hard but some of the words like 'chemical' might be a little bit rough. Because they don't really know the meaning of it.

What is the optimal amount of class time you think this program should take?

- One hour would be fine, the exact time would be set once the information and lesson plans are like. If the lesson cannot be taught within 1 hour then 2 hours would be optimal.

If you were designing this program, how would you tell your students how to protect themselves from lead?

- I would have to understand the games. Sometimes in the classroom there are not only the lesson but there are some of the simple games like hangman when I want them to learn the vocabulary.

#### Interaction with students' parents

How often do you contact students' parents?

- Mostly we will meet once a semester at the teacher-parents conference. The parents will come meet me, a homeroom teacher.

How do you usually contact with the parents?

Email

Parent-teacher conferences

Meetings

Sending notes home to parents

Phone calls

Other \_\_\_\_\_

- I always give them my personal phone number, and parent can call me at any time they like. And sometimes, I chat with the parents at the end of the class when they come and pick up their kids.

How do you think the parents will be interested in our project? We have plan to give the pamphlet to the students and let them explain those they learned to their parents. What do you think?

- The students will handle that part well. The pamphlet can be given to their parents and they will have to return the form.

Other comments?

- I would suggest the prizes as the key chains, or fancy stationery. The big dolls can be good but the budgets will be high as well.

## Student Surveys

Below you will find a blank copy of our Student Pre-Survey and Student Post-Survey for Grades 1-5. You will also find data and results on the performed surveys by students from Grades 1-5 at Wat Pathumwanaram (Bangkok) and Baan Kao Huay Mahad (Rayong).

### *Student Pre-Survey*

#### **Student Survey (Before Lesson)**

**Name:**

**Grade:**

1. Can chemicals in the environment be unhealthy?
  - a. Yes
  - b. No
2. Have you heard of lead
  - a. Yes
  - b. No
3. Where can lead be found? (You can circle multiple answers)
  - a. Painted Toys/Playgrounds
  - b. Drinking Tap Water
  - c. Dirt and Air
  - d. Food Dyes
4. Can lead make you sick?
  - a. Yes
  - b. No
5. What can you do to be safe and avoid lead? (You can circle multiple answers)
  - a. Wash your hands
  - b. No toys in mouth
  - c. Drink Milk
  - d. Eat a healthy diet which includes Calcium, Iron, and Vitamin C
6. Do you want to learn more about lead?
  - a. Yes
  - b. No

*Student Post-Survey*

**Student Survey (After Lesson)**

**Name:**

**Grade:**

1. Can chemicals in the environment be unhealthy?
  - a. Yes
  - b. No
  
2. Do you understand what lead is?
  - a. Yes
  - b. No
  
3. Where can lead be found? (You can circle multiple answers)
  - a. Painted Toys/Playgrounds
  - b. Drinking Tap Water
  - c. Dirt and Air
  - d. Food Dyes

4. Does lead make you sick?
  - a. Yes
  - b. No
  
5. What can you do to be safe and avoid lead? (You can circle multiple answers)
  - a. Wash your hands
  - b. No toys in mouth
  - c. Drink Milk
  - d. Eat a healthy diet which includes Calcium, Iron, and Vitamin C
  
6. After this lesson, do you now feel that you can protect yourself from lead exposure?
  - a. Yes
  - b. No
  
7. Did you have fun during this program about lead?
  - a. Yes
  - b. No

## Grade 1 - Bangkok

Number of Students in Class

34

Question	Pre-Survey		Post-Survey		Increase	
	#	%	#	%	#	%
<b>Can Chemicals in the environment be unhealthy?</b>	33	97%	34	100%	1	3%
<b>Have you heard of lead?</b>	16	47%	31	91%	15	44%
<b>Where can lead be found (Can choose multiple)</b>	-	-	-	-	-	-
Playgrounds	8	24%	30	88%	22	65%
Tap Water	2	6%	23	68%	21	62%
Dirt	11	32%	28	82%	17	50%
Air	17	50%	27	79%	10	29%
Painted Toys	-	-	-	-	-	-
<b>Number of sources recognized per student.</b>	-	-	-	-	-	-
Zero	0	0%	0	0%	0	0%
One	30	88%	6	18%	-24	-71%
Two	4	12%	3	9%	-1	-3%
Three	0	0%	4	12%	4	12%
Four	0	0%	21	62%	21	62%
<b>Can lead make you sick?</b>	29	85%	34	100%	5	15%
<b>What can you do to be safe and avoid lead? (Multiple)</b>	-	-	-	-	-	-
Wash Hands	17	50%	31	91%	14	41%
No Toys in Mouth	8	24%	28	82%	20	59%
Drink Milk	9	26%	26	76%	17	50%
Exercise	4	12%	22	65%	18	53%
Eat a Healthy Diet	-	-	-	-	-	-
Avoid Chipping Paint	-	-	-	-	-	-
<b>Number of prevention methods recognized.</b>	-	-	-	-	-	-
Zero	0	0%	0	0%	0	0%
One	30	88%	5	15%	-25	-74%
Two	4	12%	6	18%	2	6%
Three	0	0%	2	6%	2	6%
Four	0	0%	21	62%	21	62%
Five	-	-	-	-	-	-
<b>Do you understand lead?</b>	-	-	-	-	-	-
<b>Are you safe from lead exposure at home and school?</b>	-	-	33	97%	33	97%
<b>Did you have fun?</b>	-	-	34	100%	34	100%
<b>Which method of prevention was selected (choose 1)</b>	-	-	-	-	-	-
Wash Hands	-	-	-	-	-	-
No Toys in Mouth	-	-	-	-	-	-
Drink Milk	-	-	-	-	-	-
Exercise	-	-	-	-	-	-

## Grade 2 - Bangkok

<b>Number of Students in Class</b>	36
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Question	Pre-Survey		Post-Survey		Increase	
	#	%	#	%	#	%
<b>Can Chemicals in the environment be unhealthy?</b>	27	75%	33	92%	6	17%
<b>Have you heard of lead?</b>	9	25%	32	89%	23	64%
<b>Where can lead be found (Can choose multiple)</b>	-	-	-	-	-	-
Playgrounds	20	56%	28	78%	8	22%
Tap Water	12	33%	23	64%	11	31%
Dirt	18	50%	29	81%	11	31%
Air	12	33%	17	47%	5	14%
Painted Toys	-	-	-	-	-	-
<b>Number of sources recognized per student.</b>	-	-	-	-	-	-
Zero	0	0%	0	0%	0	0%
One	11	31%	3	8%	-8	-22%
Two	24	67%	17	47%	-7	-19%
Three	1	3%	5	14%	4	11%
Four	0	0%	11	31%	11	31%
<b>Can lead make you sick?</b>	31	86%	34	94%	3	8%
<b>What can you do to be safe and avoid lead? (Multiple)</b>	-	-	-	-	-	-
Wash Hands	25	69%	29	81%	4	11%
No Toys in Mouth	27	75%	30	83%	3	8%
Drink Milk	3	8%	25	69%	22	61%
Exercise	10	28%	8	22%	-2	-6%
Eat a Healthy Diet	-	-	-	-	-	-
Avoid Chipping Paint	-	-	-	-	-	-
<b>Number of prevention methods recognized.</b>	-	-	-	-	-	-
Zero	0	0%	0	0%	0	0%
One	8	22%	3	8%	-5	-14%
Two	25	69%	18	50%	-7	-19%
Three	3	8%	9	25%	6	17%
Four	0	0%	6	17%	6	17%
Five	-	-	-	-	-	-
<b>Do you understand lead?</b>	-	-	-	-	-	-
<b>Are you safe from lead exposure at home and school?</b>	-	-	15	42%	15	42%
<b>Did you have fun?</b>	-	-	35	97%	35	97%
<b>Which method of prevention was selected (choose 1)</b>	-	-	-	-	-	-
Wash Hands	-	-	-	-	-	-
No Toys in Mouth	-	-	-	-	-	-
Drink Milk	-	-	-	-	-	-
Exercise	-	-	-	-	-	-



## Grade 3 - Bangkok

<b>Number of Students in Class</b>	39
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Question	Pre-Survey		Post-Survey		Increase	
	#	%	#	%	#	%
<b>Can Chemicals in the environment be unhealthy?</b>	38	97%	38	97%	0	0%
<b>Have you heard of lead?</b>	26	67%	38	97%	12	31%
<b>Where can lead be found (Can choose multiple)</b>	-	-	-	-	-	-
Playgrounds	27	69%	34	87%	7	18%
Tap Water	26	67%	25	64%	-1	-3%
Dirt	13	33%	28	72%	15	38%
Air	5	13%	30	77%	25	64%
Painted Toys	-	-	-	-	-	-
<b>Number of sources recognized per student.</b>	-	-	-	-	-	-
Zero	0	0%	0	0%	0	0%
One	10	26%	4	10%	-6	-15%
Two	25	64%	8	21%	-17	-44%
Three	6	15%	11	28%	5	13%
Four	0	0%	16	41%	16	41%
<b>Can lead make you sick?</b>	7	18%	38	97%	31	79%
<b>What can you do to be safe and avoid lead? (Multiple)</b>	-	-	-	-	-	-
Wash Hands	-	-	-	-	-	-
No Toys in Mouth	-	-	-	-	-	-
Drink Milk	-	-	-	-	-	-
Exercise	-	-	-	-	-	-
Eat a Healthy Diet	-	-	-	-	-	-
Avoid Chipping Paint	-	-	-	-	-	-
<b>Number of prevention methods recognized.</b>	-	-	-	-	-	-
Zero	-	-	-	-	-	-
One	-	-	-	-	-	-
Two	-	-	-	-	-	-
Three	-	-	-	-	-	-
Four	-	-	-	-	-	-
Five	-	-	-	-	-	-
<b>Do you understand lead?</b>	-	-	-	-	-	-
<b>Are you safe from lead exposure at home and school?</b>	-	-	27	69%	27	69%
<b>Did you have fun?</b>	-	-	39	100%	39	100%
<b>Which method of prevention was selected (choose 1)</b>	-	-	-	-	-	-
Wash Hands	10	26%	10	26%	0	0%
No Toys in Mouth	24	62%	16	41%	-8	-21%
Drink Milk	0	0%	12	31%	12	31%
Exercise	4	10%	0	0%	-4	-10%

Student Survey Results - Wat Pathumwanaram (Bangkok), Summary for Grades 1-3

GRADES 1-3 - Bangkok	Total Students 109		Grade 1-2 70		Grade 3 39			
	Pre-Survey			Post-Survey			Increase	
Question	Grade	#	%	Grade	#	%	#	%
Can Chemicals in the environment be unhealthy?	1, 2, 3	98	90%	1, 2, 3	105	96%	7	6%
Have you heard of lead?	1, 2, 3	51	47%	1, 2, 3	101	93%	50	46%
Where can lead be found (Can choose multiple)	-	-	-	-	-	-	-	-
Playgrounds	1, 2, 3	55	50%	1, 2, 3	92	84%	37	34%
Tap Water	1, 2, 3	40	37%	1, 2, 3	71	65%	31	28%
Dirt	1, 2, 3	42	39%	1, 2, 3	85	78%	43	39%
Air	1, 2, 3	34	31%	1, 2, 3	74	68%	40	37%
Number of sources recognized per student.	-	-	-	-	-	-	-	-
Zero	1, 2, 3	0	0%	1, 2, 3	0	0%	0	0%
One	1, 2, 3	51	47%	1, 2, 3	13	12%	-38	-35%
Two	1, 2, 3	53	49%	1, 2, 3	28	26%	-25	-23%
Three	1, 2, 3	7	6%	1, 2, 3	20	18%	13	12%
Four	1, 2, 3	0	0%	1, 2, 3	48	44%	48	44%
Can lead make you sick?	1, 2, 3	67	61%	1, 2, 3	106	97%	39	36%
What can you do to be safe and avoid lead? (Multiple)	-	-	-	-	-	-	-	-
Wash Hands	1, 2	42	60%	1, 2	60	86%	18	26%
No Toys in Mouth	1, 2	35	50%	1, 2	58	83%	23	33%
Drink Milk	1, 2	12	17%	1, 2	51	73%	39	56%
Exercise	1, 2	14	20%	1, 2	30	43%	16	23%
Eat a Healthy Diet	-	-	-	-	-	-	-	-
Number of prevention methods recognized.	-	-	-	-	-	-	-	-
Zero	1, 2	0	0%	1, 2	0	0%	0	0%
One	1, 2	38	54%	1, 2	8	11%	-30	-43%
Two	1, 2	29	41%	1, 2	24	34%	-5	-7%
Three	1, 2	3	4%	1, 2	11	16%	8	11%
Four	1, 2	0	0%	1, 2	27	39%	27	39%
Do you understand lead?	-	-	-	-	-	-	-	-
Are you safe from lead exposure at home and school?	-	-	-	1, 2, 3	75	69%	75	69%
Did you have fun?	-	-	-	-	108	99%	108	99%
Which method of prevention was selected (choose 1)	-	-	-	-	-	-	-	-
Wash Hands	3	10	26%	3	10	26%	0	0%
No Toys in Mouth	3	24	62%	3	16	41%	-8	-21%
Drink Milk	3	0	0%	3	12	31%	12	31%
Exercise	3	4	10%	3	0	0%	-4	-10%

Student Survey Results - Wat Pathumwanaram (Bangkok), Grade 4

## Grade 4 - Bangkok

Question	Number of Students in Class				38	
	Pre-Survey		Post-Survey		Increase	
	Multiple Choice		Open-Ended			
	#	%	#	%	#	%
<b>Can Chemicals in the environment be unhealthy?</b>	37	97%	37	97%	0	0%
<b>Have you heard of lead?</b>	23	61%	-	-	-	-
<b>Where can lead be found (Can choose multiple)</b>	-	-	37	97%	-	-
Playgrounds	18	47%	-	-	-	-
Tap Water	-	-	-	-	-	-
Dirt	17	45%	-	-	-	-
Air	14	37%	-	-	-	-
Painted Toys	19	50%	-	-	-	-
<b>Number of sources recognized per student.</b>	-	-	-	-	-	-
Zero	1	3%	-	-	-	-
One	9	24%	-	-	-	-
Two	25	66%	-	-	-	-
Three	3	8%	-	-	-	-
Four	0	0%	-	-	-	-
<b>Can lead make you sick?</b>	36	95%	37	97%	1	3%
<b>What can you do to be safe and avoid lead? (Multiple)</b>	-	-	36	95%	-	-
Wash Hands	24	63%	-	-	-	-
No Toys in Mouth	18	47%	-	-	-	-
Drink Milk	4	11%	-	-	-	-
Exercise	-	-	-	-	-	-
Eat a Healthy Diet	11	29%	-	-	-	-
Avoid Chipping Paint	19	50%	-	-	-	-
<b>Number of prevention methods recognized.</b>	-	-	-	-	-	-
Zero	0	0%	-	-	-	-
One	12	32%	-	-	-	-
Two	17	45%	-	-	-	-
Three	7	18%	-	-	-	-
Four	1	3%	-	-	-	-
Five	1	3%	-	-	-	-
<b>Do you understand lead?</b>	-	-	25	66%	-	-
<b>Are you safe from lead exposure at home and school?</b>	-	-	30	79%	-	-
<b>Did you have fun?</b>	-	-	38	100%	-	-
<b>Which method of prevention was selected (choose 1)</b>	-	-	-	-	-	-
Wash Hands	-	-	-	-	-	-
No Toys in Mouth	-	-	-	-	-	-
Drink Milk	-	-	-	-	-	-
Exercise	-	-	-	-	-	-

Student Survey Results - Wat Pathumwanaram (Bangkok), Grade 5

## Grade 5 - Bangkok

Question	Number of Students in Class				28	
	Pre-Survey		Post-Survey		Increase	
	Multiple Choice		Open-Ended			
	#	%	#	%	#	%
<b>Can Chemicals in the environment be unhealthy?</b>	27	96%	28	100%	1	4%
<b>Have you heard of lead?</b>	22	79%	-	-	-	-
<b>Where can lead be found (Can choose multiple)</b>	-	-	27	96%	-	-
Playgrounds	19	68%	-	-	-	-
Tap Water	-	-	-	-	-	-
Dirt	14	50%	-	-	-	-
Air	15	54%	-	-	-	-
Painted Toys	17	61%	-	-	-	-
<b>Number of sources recognized per student.</b>	-	-	-	-	-	-
Zero	0	0%	-	-	-	-
One	5	18%	-	-	-	-
Two	14	50%	-	-	-	-
Three	4	14%	-	-	-	-
Four	5	18%	-	-	-	-
<b>Can lead make you sick?</b>	27	96%	28	100%	1	4%
<b>What can you do to be safe and avoid lead? (Multiple)</b>	-	-	26	93%	-	-
Wash Hands	15	54%	-	-	-	-
No Toys in Mouth	18	64%	-	-	-	-
Drink Milk	0	0%	-	-	-	-
Exercise	-	-	-	-	-	-
Eat a Healthy Diet	2	7%	-	-	-	-
Avoid Chipping Paint	18	64%	-	-	-	-
<b>Number of prevention methods recognized.</b>	-	-	-	-	-	-
Zero	0	0%	-	-	-	-
One	13	46%	-	-	-	-
Two	7	25%	-	-	-	-
Three	6	21%	-	-	-	-
Four	2	7%	-	-	-	-
Five	0	0%	-	-	-	-
<b>Do you understand lead?</b>	-	-	25	89%	-	-
<b>Are you safe from lead exposure at home and school?</b>	-	-	7	25%	-	-
<b>Did you have fun?</b>	-	-	28	100%	-	-
<b>Which method of prevention was selected (choose 1)</b>	-	-	-	-	-	-
Wash Hands	-	-	-	-	-	-
No Toys in Mouth	-	-	-	-	-	-
Drink Milk	-	-	-	-	-	-
Exercise	-	-	-	-	-	-

Student Survey Results - Wat Pathumwanaram (Bangkok), Summary for Grades 4-5

Question	Grade 4-5 - Bangkok							
	Number of Students in Classes						66	
	Pre-Survey			Post-Survey			Increase	
	Multiple Choice			Open-Ended				
Grade	#	%	Grade	#	%	#	%	
Can Chemicals in the environment be unhealthy?	4, 5	64	97%	4, 5	65	98%	1	2%
Have you heard of lead?	4, 5	45	68%	-	-	-	-	-
Where can lead be found (Can choose multiple)	-	-	-	4, 5	64	97%	-	-
Playgrounds	4, 5	37	56%	-	-	-	-	-
Tap Water	-	-	-	-	-	-	-	-
Dirt	4, 5	31	47%	-	-	-	-	-
Air	4, 5	29	44%	-	-	-	-	-
Painted Toys	4, 5	36	55%	-	-	-	-	-
Number of sources recognized per student.	-	-	-	-	-	-	-	-
Zero	4, 5	1	2%	-	-	-	-	-
One	4, 5	14	21%	-	-	-	-	-
Two	4, 5	39	59%	-	-	-	-	-
Three	4, 5	7	11%	-	-	-	-	-
Four	4, 5	5	8%	-	-	-	-	-
Can lead make you sick?	4, 5	63	95%	4, 5	65	98%	2	3%
What can you do to be safe and avoid lead? (Multiple)	-	-	-	4, 5	62	94%	-	-
Wash Hands	4, 5	39	59%	-	-	-	-	-
No Toys in Mouth	4, 5	36	55%	-	-	-	-	-
Drink Milk	4, 5	4	6%	-	-	-	-	-
Exercise	-	-	-	-	-	-	-	-
Eat a Healthy Diet	4, 5	13	20%	-	-	-	-	-
Avoid Chipping Paint	4, 5	37	56%	-	-	-	-	-
Number of prevention methods recognized.	-	-	-	-	-	-	-	-
Zero	4, 5	0	0%	-	-	-	-	-
One	4, 5	25	38%	-	-	-	-	-
Two	4, 5	24	36%	-	-	-	-	-
Three	4, 5	13	20%	-	-	-	-	-
Four	4, 5	3	5%	-	-	-	-	-
Five	4, 5	1	2%	-	-	-	-	-
Do you understand lead?	-	-	-	4, 5	50	76%	-	-
Are you safe from lead exposure at home and school?	-	-	-	4, 5	37	56%	-	-
Did you have fun?	-	-	-	4, 5	66	100%	-	-

Student Survey Results - Wat Pathumwanaram (Bangkok), Overall Summary for Grades 1-5

GRADES 1-5 - Bangkok	Students 175		Grades 1-2 70		Grade 3 39		Grades 4-5 66	
	Overall Pre-Survey			Overall Post-Survey			Overall Change	
	Grade	#	%	Grade	#	%	#	%
Can Chemicals in the environment be unhealthy?	1,2,3,4 5	162	93%	1,2,3,4 5	170	97%	8	5%
Have you heard of lead?	1,2,3,4 5	96	55%	1, 2, 3	101	93%	5	38%
Where can lead be found (Can choose multiple)	-	-	-	4, 5	64	97%	-	-
Playgrounds	1,2,3,4 5	92	53%	1, 2, 3	92	84%	0	32%
Tap Water	1, 2, 3	40	37%	1, 2, 3	71	65%	31	28%
Dirt	1,2,3,4 5	73	42%	1, 2, 3	85	78%	12	36%
Air	1,2,3,4 5	63	36%	1, 2, 3	74	68%	11	32%
Painted Toys	4, 5	36	55%	-	-	-	-	-
Number of sources recognized per student.	-	-	-	-	-	-	-	-
Zero	1,2,3,4 5	1	1%	1, 2, 3	0	0%	-1	-1%
One	1,2,3,4 5	65	37%	1, 2, 3	13	12%	-52	25%
Two	1,2,3,4 5	92	53%	1, 2, 3	28	26%	-64	27%
Three	1,2,3,4 5	14	8%	1, 2, 3	20	18%	6	10%
Four	1,2,3,4 5	5	3%	1, 2, 3	48	44%	43	41%
Can lead make you sick?	1,2,3,4 5	130	74%	1,2,3,4 5	171	98%	41	23%
What can you do to be safe and avoid lead? (Multiple)	-	-	-	4, 5	62	94%	-	-
Wash Hands	1, 2, 4, 5	81	60%	1, 2	60	86%	-21	26%
No Toys in Mouth	1, 2, 4, 5	71	52%	1, 2	58	83%	-13	31%
Drink Milk	1, 2, 4, 5	16	12%	1, 2	51	73%	35	61%
Exercise	1, 2	14	20%	1, 2	30	43%	16	23%
Eat a Healthy Diet	4, 5	13	20%	-	-	-	-	-
Avoid Chipping Paint	4, 5	37	56%	-	-	-	-	-

Continue results on next page...

<b>Question</b>	<b>Overall Pre-Survey</b>			<b>Overall Post-Survey</b>			<b>Overall Change</b>	
	<b>Grade</b>	<b>#</b>	<b>%</b>	<b>Grade</b>	<b>#</b>	<b>%</b>	<b>#</b>	<b>%</b>
<b>Number of prevention methods recognized.</b>	-	-	-	-	-	-	-	-
Zero	1, 2, 4, 5	0	0%	1, 2	0	0%	0	0%
One	1, 2, 4, 5	63	46%	1, 2	8	11%	-55	35%
Two	1, 2, 4, 5	53	39%	1, 2	24	34%	-29	-5%
Three	1, 2, 4, 5	16	12%	1, 2	11	16%	-5	4%
Four	1, 2, 4, 5	3	2%	1, 2	27	39%	24	36%
Five	4, 5	1	2%	-	-	-	-	-
<b>Do you understand lead?</b>	-	-	-	4, 5	50	76%	-	-
<b>Are you safe from lead exposure at home and school?</b>	-	-	-	1,2,3,4 5	112	64%	-	-
<b>Did you have fun?</b>	-	-	-	1,2,3,4 5	174	99%	-	-
<b>Which method of prevention was selected (choose 1)</b>	-	-	-	-	-	-	-	-
Wash Hands	3	10	26%	3	10	26%	0	0%
No Toys in Mouth	3	24	62%	3	16	41%	-8	21%
Drink Milk	3	0	0%	3	12	31%	12	31%
Exercise	3	4	10%	3	0	0%	-4	10%

## Grade 3 - Rayong

<b>Number of Students in Class</b>	17
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Question	Pre-Survey		Post-Survey		Increase	
	#	%	#	%	#	%
<b>Can Chemicals in the environment be unhealthy?</b>	17	100%	17	100%	0	0%
<b>Have you heard of lead?</b>	17	100%	17	100%	0	0%
<b>Where can lead be found (Can choose multiple)</b>						
Toys and Playgrounds	12	71%	12	71%	0	0%
Tap Water	14	82%	15	88%	1	6%
Dirt and Air	14	82%	13	76%	-1	-6%
Colorful Food with dyes	11	65%	12	71%	1	6%
<b>Number of sources recognized per student.</b>						
Zero	0	0%	0	0%	0	0%
One	5	29%	5	29%	0	0%
Two	1	6%	0	0%	-1	-6%
Three	0	0%	1	6%	1	6%
Four	11	65%	11	65%	0	0%
<b>Can lead make you sick?</b>	16	94%	17	100%	1	6%
<b>What can you do to be safe and avoid lead? (Multiple)</b>						
Wash Hands	16	94%	16	94%	0	0%
No Toys in Mouth	9	53%	12	71%	3	18%
Drink Milk	10	59%	11	65%	1	6%
Eat Calcium, Iron and Vitamin C	9	53%	12	71%	3	18%
<b>Number of prevention methods recognized.</b>						
Zero	0	0%	0	0%	0	0%
One	8	47%	5	29%	-3	-18%
Two	0	0%	0	0%	0	0%
Three	0	0%	2	12%	2	12%
Four	9	53%	10	59%	1	6%
<b>Do you know how to protect yourself from lead?</b>			17	100%		
<b>Did you have fun?</b>			17	100%		



## Grade 5 - Bangkok

Number of Students in Class

14

Question	Pre-Survey		Post-Survey		Increase	
	#	%	#	%	#	%
Can Chemicals in the environment be unhealthy?	13	93%	13	93%	0	0%
Have you heard of lead?	14	100%	14	100%	0	0%
<b>Where can lead be found (Can choose multiple)</b>						
Toys and Playgrounds	13	93%	14	100%	1	7%
Tap Water	1	7%	14	100%	13	93%
Dirt and Air	0	0%	14	100%	14	100%
Colorful Food with dyes	5	36%	13	93%	8	57%
<b>Number of sources recognized per student.</b>						
Zero	0	0%	0	0%	0	0%
One	9	64%	0	0%	-9	-64%
Two	5	36%	0	0%	-5	-36%
Three	0	0%	1	7%	1	7%
Four	0	0%	13	93%	13	93%
Can lead make you sick?	14	100%	14	100%	0	0%
<b>What can you do to be safe and avoid lead? (Multiple)</b>						
Wash Hands	13	93%	13	93%	0	0%
No Toys in Mouth	4	29%	9	64%	5	36%
Drink Milk	0	0%	12	86%	12	86%
Eat Calcium, Iron and Vitamin C	4	29%	11	79%	7	50%
<b>Number of prevention methods recognized.</b>						
Zero	0	0%	0	0%	0	0%
One	8	57%	4	29%	-4	-29%
Two	5	36%	1	7%	-4	-29%
Three	1	7%	0	0%	-1	-7%
Four	0	0%	9	64%	9	64%
Do you know how to protect yourself from lead?	-	-	14	100%		
Did you have fun?	-	-	14	100%		

Student Surveys Results - Baan Khao Huay Mahad (Rayong), Summary for Grades 3 & 5

## GRADES 3 & 5 - Rayong

<b>Students</b>	31	<b>Grade 3</b>	17	<b>Grade 5</b>	14
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Question	Pre-Survey		Post-Survey		Increase	
	#	%	#	%	#	%
<b>Can Chemicals in the environment be unhealthy?</b>	30	97%	30	97%	0	0%
<b>Have you heard of lead?</b>	31	100%	31	100%	0	0%
<b>Where can lead be found (Can choose multiple)</b>						
Toys and Playgrounds	25	81%	26	84%	1	3%
Tap Water	15	48%	29	94%	14	45%
Dirt and Air	14	45%	27	87%	13	42%
Colorful Food with dyes	16	52%	25	81%	9	29%
<b>Number of sources recognized per student.</b>						
Zero	0	0%	0	0%	0	0%
One	14	45%	5	16%	-9	-29%
Two	6	19%	0	0%	-6	-19%
Three	0	0%	2	6%	2	6%
Four	11	35%	24	77%	13	42%
<b>Can lead make you sick?</b>	30	97%	31	100%	1	3%
<b>What can you do to be safe and avoid lead? (Multiple)</b>						
Wash Hands	29	94%	29	94%	0	0%
No Toys in Mouth	13	42%	21	68%	8	26%
Drink Milk	10	32%	23	74%	13	42%
Eat Calcium, Iron and Vitamin C	13	42%	23	74%	10	32%
<b>Number of prevention methods recognized.</b>						
Zero	0	0%	0	0%	0	0%
One	16	52%	9	29%	-7	-23%
Two	5	16%	1	3%	-4	-13%
Three	1	3%	2	6%	1	3%
Four	9	29%	19	61%	10	32%
<b>Do you know how to protect yourself from lead?</b>			31	100%		
<b>Did you have fun?</b>			31	100%		

*Student Surveys Results - Wat Pathumwanaram (Bangkok) and Baan Khao Huay Mahad (Rayong), Overall Summary*

## ALL STUDENTS SURVEYED

<b>Students</b>	206	<b>Bangkok</b>	175	<b>Rayong</b>	31
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<b>Question</b>	<b>Pre-Survey</b>		<b>Post-Survey</b>		<b>Increase</b>	
	<b>#</b>	<b>%</b>	<b>#</b>	<b>%</b>	<b>#</b>	<b>%</b>
Can Chemicals in the environment be unhealthy?	192	93%	200	97%	8	4%
Can lead make you sick?	160	78%	202	98%	42	20%
Did you have fun?		1	205	100%		

## Teacher Post-Interviews

Below you will find a blank copy of our Teacher Post-Interviews, as well as completed Teacher Post-Interviews by various teachers from Wat Pathumwanaram (Bangkok) and Baan Khao Huay Mahad (Rayong). These interviews were performed at the end of implementation to gain feedback for our program re-design.

*Teacher Post-Interview (Blank)*

### **Post-Educational Program for Teachers**

Name:

Grade/Age of Students Teaching:

Number of Students in Class:

**Was the lesson plan easy for you to understand?**

**Did you modify the plan to better suit your needs?**

**Are there any concepts that were difficult to convey?**

**Were the students receptive to your information?**

**Were they able to understand the information and apply it to the quiz game?**

**Was the game an effective way to test knowledge?**

**Did they have fun during the activity?**

**Was there a positive atmosphere/outcome during your lesson?**

**Do you think it was effective for lead education?**

**Do you think the information scared the students or made them nervous?**

**Do you think that the program should be repeated for other students?**

**Could you have facilitated this without any instruction from the project team?**

**What changes would you make?**

**Is there anything else you would like to add?**

**Grade 1 – Bangkok – Mrs. Sumontha Eakeium**

**Q:** Is the lesson plan easy to understand?

**A:** *Yes, I did*

**Q:** Did you adjust anything on the lesson plan to suit your teaching style?

**A:** *No, I didn't*

**Q:** Are there any difficult topics to be delivered to the students?

**A:** *Don't have*

**Q:** Were the students receptive to our information?

**A:** *Yes its good*

**Q:** Did the students understand the lesson and take the information to apply to their daily lives?

**A:** *The students understood*

**Q:** Is the game a suitable learning method?

**A:** *It's suitable*

**Q:** Did the students have fun?

**A:** *Fun*

**Q:** Was there a positive atmosphere/outcome during the lesson?

**A:** *I'm not sure*

**Q:** Do you think this activity was successful in giving education about lead poisoning?

**A:** *Since students haven't known about lead exposure as much as they should know*

**Q:** Do you think the information scared the students?

**A:** *No*

**Q:** Do you think that we should have these activities in other schools?

**A:** *Should do*

**Q:** If you are the one facilitating the lesson plans, would you be able to do it on your own

**A:** *Yes*

**Q:** Are the pre and post surveys effect evaluation methods

**A:** *Yes, they are efficient*

**Q:** Do you suggest any adjustments?

**A:** *No answer*

**Grade 2 – Bangkok – Mrs. Thanyanant Punset**

**Q:** Is the lesson plan easy to understand?

**A:** *Easy to learn and suitable for teaching*

**Q:** Did you adjust anything on the lesson plan to suit your teaching style?

**A:** *No, did not change lesson plan but adapted to main lesson*

**Q:** Are there any difficult topics to be delivered to the students?

**A:** *Some topics, like the definition of lead and chemical*

**Q:** Were the students receptive to our information?

**A:** *Yes it's good*

**Q:** Did the students understand the lesson and take the information to apply to their daily lives?

**A:** *They understood and will be able to use tis knowledge in their activities*

**Q:** Is the game a suitable learning method?

**A:** *Appropriate to test knowledge*

**Q:** Did the students have fun?

**A:** *Fun*

**Q:** Was there a positive atmosphere/outcome during the lesson?

**A:** *Yes*

**Q:** Do you think this activity was successful in giving education about lead poisoning?

**A:** *Successful*

**Q:** Do you think the information scared the students?

**A:** *No*

**Q:** Do you think that we should have these activities in other schools?

**A:** *All students should be able to join*

**Q:** If you are the one facilitating the lesson plans, would you be able to do it on your own

**A:** *Yes, because the outcome is helpful for the students and parents*

**Q:** Are the pre and post surveys effect evaluation methods

**A:** *Yes, fair*

**Q:** Do you suggest any adjustments?

**A:** *Students should participate more*

*Teacher Post-Interview - A. Jirachaya Chobtham, Grade 3, Wat Pathumwanaram (Bangkok)*

**Grade 3 – Bangkok – Mrs. Jirachaya Chobtham**

**Q:** Is the lesson plan easy to understand?

**A:** *Yes, easy to understand*

**Q:** Did you adjust anything on the lesson plan to suit your teaching style?

**A:** *No*

**Q:** Are there any difficult topics to be delivered to the students?

**A:** *Some topics such as the definition of lead and a chemical*

**Q:** Were the students receptive to our information?

**A:** *Yes it's good*

**Q:** Did the students understand the lesson and take the information to apply to their daily lives?

**A:** *Yes they understood and can adapt this knowledge in other activities*

**Q:** Is the game a suitable learning method?

**A:** *Some questions were hard for the students to answer*

**Q:** Did the students have fun?

**A:** *Fun*

**Q:** Was there a positive atmosphere/outcome during the lesson?

**A:** *Good*

**Q:** Do you think this activity was successful in giving education about lead poisoning?

**A:** *The activity is successful*

**Q:** Do you think that we should have these activities in other schools?

**A:** *All classes should be able to join*

**Q:** If you are the one facilitating the lesson plans, would you be able to do it on your own

**A:** *Yes*

**Q:** Are the pre and post surveys effect evaluation methods

**A:** *Yes, fair*

**Q:** Do you suggest any adjustments?

**A:** *Students should participate more*

**Q:** Any suggestions?

**A:** *Everyone should know the health effects of lead*

**Grade 5 – Bangkok – Mrs. Jitpinant Ditpisithkul**

**Q:** Is the lesson plan easy to understand?

**A:** *It is easy to understand the content of the teaching agenda*

**Q:** Did you adjust anything on the lesson plan to suit your teaching style?

**A:** *Did not change but did recommend things, such as allowing the college students to teach the lesson*

**Q:** Are there any difficult topics to be delivered to the students?

**A:** *After interviewing the students, they found it was hard to remember the name of chemistry*

**Q:** Were the students receptive to our information?

**A:** *Students are interested in gaining knowledge because not only is it new knowledge, but the people in charge are the ones taking the initiative, people have gained new knowledge from new teachers*

**Q:** Did the students understand the lesson and take the information to apply to their daily lives?

**A:** *The students understood everything, they had fun and the information is very interesting. So, Yes.*

**Q:** Is the game a suitable learning method?

**A:** *Activities and games are effective methods to measure knowledge and understanding*

**Q:** Did the students have fun?

**A:** *Received entertainment and became acquainted on a friendly level*

**Q:** Was there a positive atmosphere/outcome during the lesson?

**A:** *Good*

**Q:** Do you think this activity was successful in giving education about lead poisoning?

**A:** *Is successful in giving knowledge pertaining to the effects of lead*

**Q:** Do you think that we should have these activities in other schools?

**A:** *It is an activity that is knowledge. Able to change the content to suit the grade being taught in the form it is presented in.*

**Q:** If you are the one facilitating the lesson plans, would you be able to do it on your own

**A:** *Yes*

**Q:** Are the pre and post surveys effective evaluation methods

**A:** *Yes it is usable. There may be some questions that may be too hard or cause confusion.*

**Q:** Do you suggest any adjustments?

**A:** *During game and activity time, they need to keep the area ordered and fair, while maintaining fun. Have gained knowledge according to the objective of the game.*

**Q:** Any suggestions?

**A:** *The form and method of the activities has already been thought out for other people to use easily again. If they made a DVD for the teachers, it will be easier to spread to other people.*



**Grade 3 & 5 – Rayong – Mrs. Supatra Kusolwong**

**Q:** Is the lesson plan easy to understand?

**A:** *It is easy because it is suitable for the age group and is cooperative of what the students are being learned right now. It is not hard to explain. You used the story telling to give the information to the students and this is the initiating part for their attention. They are all interested once they heard the word 'story' and you insert some important information here and there into it, I am sure the kids followed the storyline more than just normal lecturing. I observed from how they answered the questions, I think the lesson plans are pretty easy to comprehend, not too easy and not too hard.*

**Q:** Did you adjust anything on the lesson plan to suit your teaching style?

**A:** *I don't think there needs to be any adjustment, there was an introduction before leading into the information that are needed to be told. And I will say the game time is the conclusion to the kids when you revealed the answer to the whole class. I think this is really a good lesson plan and activities.*

**Q:** Are there any difficult topics to be delivered to the students?

**A:** *Too hard? I think all of it are okay, not too informative and they have just right perceptive level of understanding with the information you gave to them. It is also not hard because all the topics linked to each other. The sources, the dangers of it and so the kids have to protect themselves. It is pretty good in ordering, not hard at all. The lesson covers everything that the kids at this level supposed to know.*

**Q:** Were the students receptive to our information?

**A:** *I think they learn better. If I would have the suggestion, I wouldn't suggest you but my students instead. Thai kids are shy, they don't really speak up in front of the class and they never get to speak on through the microphone before. So, I am not sure how much are they enjoying and how much did they get from you. But I know they gained more information after you taught them, just they didn't express that for us to see obviously.*

**Q:** Did the students understand the lesson and take the information to apply to their daily lives?

**A:** *From what I can see, they can answer that questions from the games. Some of them might need a hint, and some of them just know on the top of their heads. I think they are doing fine. If they can answer the questions, then that means they understood the information*

**Q:** Is the game a suitable learning method?

**A:** *For me, I think soi dao should have been adapted a little bit. The activities in which the kids get to stand up, move here and there are preferred. They were having fun, but it could have been a little bit better than just sit and go out to the front.*

**Q:** Did the students have fun?

**A:** *I think they all had fun today, I can see it from their eyes especially the kids in the front row. Those kids are more active than the others, and if you ask them something you will get a pretty cooperative feedback.*

**Q:** Was there a positive atmosphere/outcome during the lesson?

**A:** *I think it is very good, the kids are cooperative and enjoy*

**Q:** Do you think this activity was successful in giving education about lead poisoning?

**A:** *I will say it is very suitable for the kids, the information was all related to the lead poisoning and the information that the kids need to know were provided in all the activities you performed. Also, I think they might have gained more knowledge about washing hands and something else that they never know before.*

**Q:** Do you think the information scared the students?

**A:** *I think they are scared, but in this case I think they are scared for good reason. Because they will think that they wouldn't want the bad thing to happen to themselves. So it is good that they are scared of this so they will try to protect themselves the way we wanted them to willingly. But I am not worried, they will now take care of themselves to be safe from lead.*

**Q:** Do you think that we should have these activities in other schools?

**A:** *It is an activity that is knowledge. Able to change the content to suit the grade being taught in the form it is presented in.*

**Q:** If you are the one facilitating the lesson plans, would you be able to do it on your own/would you make any changes?

**A:** *I think you should, for the younger kids. I will suggest that the invitation to the parents will be good as well. Sometimes, the kids cannot express the information to the parents correctly and we do. We always have meeting with the parents once or twice per semester. I think I will be able to do it on my own because it is easy to follow. In my thought, I think it is easy. For the cartoon, I would suggest the animated pictures, especially those that are popular now like angry birds...or something. The pre and post survey are not too hard, it tested a lot of abilities of the students as in how they understood, how they analyse the information. It is good that the*

*questions of both set are the same because they can see the difference of what they answered at the pre-test, and so for the post-test, they will not get it wrong again. I would have the minimum 10 questions per test. For the questions with multiple answers, I would have them write out as much as they can so that they will learn how to write Thai as well. Like for 10 questions, I will have 8 multiple choices questions and the rest will be writing ones.*

**Q:** Anything else to add?

**A:** *I would like you to add the conclusion on the slides a little bit. So that after the story, they can gather the information on their minds. And like I said, the cartoon figures should be added more. The pamphlet is okay, good information are in the right amount. You might add another game instead of one game such as the questions and have them run and write on the board if they can answer. For the story, if there is the subtitle under the slide for them to follow along the storyline easily. Overall, you have done great job on creating this lesson plan for us. Thank you for coming to us as well.*

## Deliverables

### Lesson Plan (Grades 1-3)

Below you will find our complete lesson plan designated for Grades 1-3. This is all-inclusive and can also be found as a digital copy in Thai language on our website:

<http://sites.google.com/site/leadfreecommunity/home>

# Raising Awareness about Childhood Lead Exposure in Schools in Thailand



*Lesson Plan  
Grades 1-3*

# Welcome, and thank you!

*We are very excited that you have chosen to participate in our educational program on raising awareness about childhood lead exposure in schools in Thailand. We have worked very hard on this program and feel that it will greatly help educate your students on the basics of the chemical lead and what steps they can take to live a healthier lifestyle. We have also included pamphlets for the parents, teachers, and administration of the school community to further the education of the student's support system. This is all in an effort to raise awareness of lead concerns and exemplify healthy practices to your students, the future of Thailand.*

*In the early stages of designing this program, we interviewed teachers in Thailand to get a better understanding of how the students would learn best, what activities they would find interesting and enjoyable, and what lesson plans teachers would prefer. We feel that we have created the most effective program using suggestions by teachers in Thailand to best educate the students about various lead sources and prevention tips.*

*Also, during the creation of this program, the children's well being was of upmost concern. We did not want the material to be so frightening that the students did not feel comfortable playing on playgrounds or with various toys. Our main goal is to raise awareness among the students in a fun, informative way so that they feel that chemical lead is not something to be afraid of, but rather something to be aware of.*

*With your help, we can teach these young children basic information on lead poisoning and various ways they can protect themselves. Again, thank you for participating in this program, and we hope that it may guide your students in the positive direction to a lead free community.*

**- The Lead Education Team**



# Program Overview

<b>Pre-Student Surveys .....</b>	<b>112</b>
<b>Short Story .....</b>	<b>112</b>
<b>Soi Dao Game .....</b>	<b>113</b>
<b>Student Post-Survey .....</b>	<b>114</b>
<b>Lead Boy and Lead Girl Stickers/ Parent Letter and Pamphlet .....</b>	<b>114</b>



# Pre-Student Surveys

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*The first portion of the educational program is the Student Pre-Survey (See the Appendix for the Student Pre-Survey Template). The purpose of the pre-survey is solely for the students to answer questions about the chemical lead to the best of their ability and to compare it's results with the Student Post-Survey at the end of the program. This will determine whether the students retained their new knowledge about lead exposure.*

Pass the pre-survey out to each student and administer to students at teacher discretion.

Be sure that each student writes his or her name on the survey. We recommend a teacher-administered survey for the younger age group. The questions are simple, but this will allow for explanations and answers to any questions that may arise.

Once the students have completed the survey, collect and store for later use.

# Short Story

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*The next portion of the program is the Short Story (See the Appendix for the Short Story). The Short Story acts as the lecture for the younger students. This is a fun story featuring Lead Boy and Lead Girl, the two super heroes that dedicate their lives to raising awareness about lead poisoning and exposure prevention to children. This short story will ideally inform the students, while keeping them engaged.*

*There is also an additional PowerPoint multimedia that goes along with the Short Story if your school has projecting capabilities. This show contains images that may further engage the students.*

Gather the students and read the Short Story in a fun and interesting way. If your school has projecting capabilities, play the PowerPoint show.

After the story, recap what happened in the story with the students and highlight key points that are asked of the students in the Student Surveys.





# Soi Dao Game

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*The next portion of the program is the Soi Dao Game (See the Appendix for Soi Dao Materials Templates and Soi Dao Game Question Sheet). The purpose of the Soi Dao Game is to quiz the children on their new knowledge of lead poisoning.*

Print out approximately 20 stars and number them 1-20. (This number depends on the number of students in the class; the number 20 is based on a class of 40 students.) Hang the stars up on a long string like a standard Soi Dao Game. Follow the Soi Dao Game Instructions below.

## Soi Dao Game Instructions

1. Pair students up with a partner (or teacher's personal preference depending on class size)
2. Each pair of students randomly picks a paper star
3. Have kids sit together and call number 1. Ask the students who pulled start number 1. Then ask these students the question that correlates to number 1 on the Soi Dao Game Question Sheet (See the Appendix).
4. Before telling the pair if they are correct, ask the class for their opinion.
5. When the pair gets the correct answer, reward the students with a prize (We recommend pencils, key chains, dolls, or candy. We also recommend bonus points.)
6. Repeat steps 3-5 until every pair has answered a question.

**\*\*Note:** The set up of this game does require some preparation, so teachers may alter the game. Another way this game may be prepared, which takes less time to create, is simply putting small pieces of paper, numbered 1-20, in a hat or container and having students select from the pool.



# Student Post-Survey

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*The next portion of the program is the Student Post-Survey (See the Appendix for the Student Post-Survey Template). The purpose of the post-survey is solely for the students to answer questions about what they learned throughout the program and compare it's results with the Student Pre-Survey given at the beginning of the program. This will determine whether the students retained their new knowledge about lead exposure.*

Pass the post-survey out to each student and administer to students at teacher discretion. Be sure that each student writes his or her name on the survey. We recommend a teacher-administered survey for the younger age group. The questions are simple, but this will allow for explanations and answers to any questions that may arise.

Once the students have completed the survey, collect and compare with Student Pre-Survey results.

## Lead Boy and Lead Girl Stickers/Parent Letter and Pamphlet

*The final portion of the educational program is to distribute the Lead Boy and Lead Girl Stickers (See the Appendix for the Lead Boy and Lead Girl Sticker Templates) and the Parent Letter and Pamphlet (See the Appendix for the Parent Letter and Pamphlet). The purpose of the stickers is to remind the students of what they learned during the program. The purpose of the Parent Letter and Pamphlet is to inform the student's parents about what their children have just learned and how they can continue to encourage healthy habits.*

Distribute one sticker to each student.

Distribute one Parent Letter and one Parent Pamphlet to each student. We also recommend requiring a signature from the parents to ensure that the student provided this information to their parent. This is to the school administration's discretion.



# Thank you!

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*You have successfully completed the **Raising Awareness about Childhood Lead Exposure in Schools in Thailand** educational program. Thank you for your time and we hope that this lesson was simple to understand and enjoyable to teach. We look forward to any feedback you may provide on your experience during the lesson. Be sure to refer to our website: <http://sites.google.com/site/leadfreecommunity> and contact us by emailing [bkk13lead@gmail.com](mailto:bkk13lead@gmail.com)*



# Appendix

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Below you will find all of the materials necessary to complete this lesson plan. All electronic material (including all PowerPoints and other informational documents) may be found at our website <http://sites.google.com/site/leadfreecommunity> within the “Teachers” tab.



Student Survey (Before Lesson)

Name:

Grade:

1. Can chemicals in the environment be unhealthy?

- a. Yes
- b. No

2. Have you heard of lead

- a. Yes
- b. No

3. Where can lead be found?

(You can circle multiple answers)

- a. Painted  
Toys/Playgrounds
- b. Drinking Tap Water
- c. Dirt and Air
- d. Food Dyes

4. Can lead make you sick?

- a. Yes
- b. No

5. What can you do to be safe and avoid lead? (You can circle multiple answers)

- a. Wash your hands
- b. No toys in mouth
- c. Drink Milk
- d. Eat a healthy diet which includes Calcium, Iron, and Vitamin C

6. Do you want to learn more about lead?

- a. Yes
- b. No



# Short Story

Before the story, please define the terms “lead” and “chemical”.

**Lead** - Lead is a **chemical**, which may be present in our environment at any time.

**Chemical** - A pure substance that is a solid, liquid or gas that may cause allergy, irritation, corrosion, and cancer. A chemical may be harmful to your health.



## The Lead-Heroes

Once upon a time in a world just like our own lived a young boy and a young girl named Lead Boy and Lead Girl. These children were superheroes who fought crime against lead poisoning in schools all around Thailand. Every day they visit different schools and neighborhoods to help save other children from the harmful threat of lead exposure. So the story begins...

[[BEEP BEEP BEEP]] goes the sound of Lead Girl’s alarm. “[Yawn]... Time to get up!” she says as she slowly gets out of bed. As she walks down the hallway, Lead Girl bangs on Lead Boy’s door and shouts, “Wake up brother, we have a long day ahead of us!” She walks down the stairs of their super hero lair and heads to the kitchen. She takes out two bowls, spoons, cereal, and milk. As she pours the milk over the cereal, Lead Boy walks down the stairs.

“Good Morning Sis. What’s for breakfast?”

Lead Girl says, “Cereal with a cup of milk! Milk will give us healthy bones and help keep lead away!”

“That’s right, sis. Milk has calcium, which is a nutrient that will keep lead away. Other foods have calcium Eating healthy is a great step to stay away from bad chemicals like lead.”

“Yeah! So what’s on the schedule for today?” Lead Girl asks.

“Well, you were right. We do have a very busy day,” says Lead Boy, as the kitchen counter becomes a touch screen computer, displaying the superhero’s mission for the day. “Today we will be going to different neighborhoods and playgrounds to teach children the basics about lead exposure and how they can protect themselves from this bad chemical.”

“Well, we better get going!” responds Lead Girl. “To the platform!”

Lead Boy and Lead Girl walk to a large, circular platform at the front of the lair. They hold hands, put one fist in the air, and count, “1...2...3...GO!” The children begin flying through



space, twisting and turning, spinning and swerving, until they arrive at an old, chipped, and rusty playground.

The heroes land perfectly on their feet and the children at the playground cheer, “Yay! Lead Boy and Lead Girl are here!” The children are very excited to see these superheroes and can’t wait to learn about the bad chemical named lead and what they can do to protect themselves.

“Alright Lead Boy. First stop, the jungle gym!” exclaims Lead Girl.

As the heroes walk to the center of the playground, they notice a young boy playing with an old toy truck and a young girl playing on the handlebars of the old playground.

“Well hello children,” says Lead Boy. “We’re Lead Boy and Lead Girl and we’re here to help you stay safe from a chemical called lead.”

“Yes,” says Lead Girl. “We don’t want to scare you but tell you what you can do to protect yourselves.”

Lead Boy sits with the young boy. “So, see this toy truck? It looks like it is very old and the paint is chipping off.”

“It looks like the same with these handlebars on the playground. The paint is very old and chipping, which is not good,” says Lead Girl.

“Paint that contains lead is the number one source of lead exposure in humans. This can be harmful to your body by making you feel sick.” says Lead Boy.

“Yes, and if you chip any of the paint off of these old toys and playgrounds and put it in your mouth or touches a cut on your skin, the bad chemical may get into your body and cause you to get sick! Chipping old paint may also cause lead particles to travel through the air. So just be careful and look out for old chipping paint. Don’t peel the paint and definitely do not put any in your mouth,” says Lead Girl.

“Sounds good!” cheer the little boy and girl. “Thank you Lead Boy and Lead Girl!” The two children then go play on a new jungle gym that does not have old, chipping paint.

“Lead Girl, look!” says Lead Boy. He points to a young boy playing in the dirt on the edge of the playground. The little boy then gets up gets his snack out of his backpack.

“Hi little boy! We’re Lead Boy and Lead Girl and we’re here to help you stay safe from a chemical called lead.” says Lead Girl.

“Cool, thanks!” says the little boy. “What can I do?”

“Well, first of all, you shouldn’t

play in the dirt because the chemical



lead may be found in the soil and if you have any cuts, it may enter your body and make you feel sick,” says Lead Boy.

“Yes, and if you’re about to eat your snack, you should definitely wash your hands. Whenever you eat food, you should always wash your hands thoroughly to make sure they are clean from any bad stuff that make your hands dirty and can make you sick, like lead!” says Lead Girl.

“Sounds good! Thanks Lead Boy and Lead Girl” says the little boy as he runs to the toilet to wash his hands.

“Another child protecting himself from lead.” says Lead Girl. “It makes me happy that these children are learning how to practice healthy habits.”

“Yeah,” says Lead Boy. “Now let’s say goodbye to the children.”

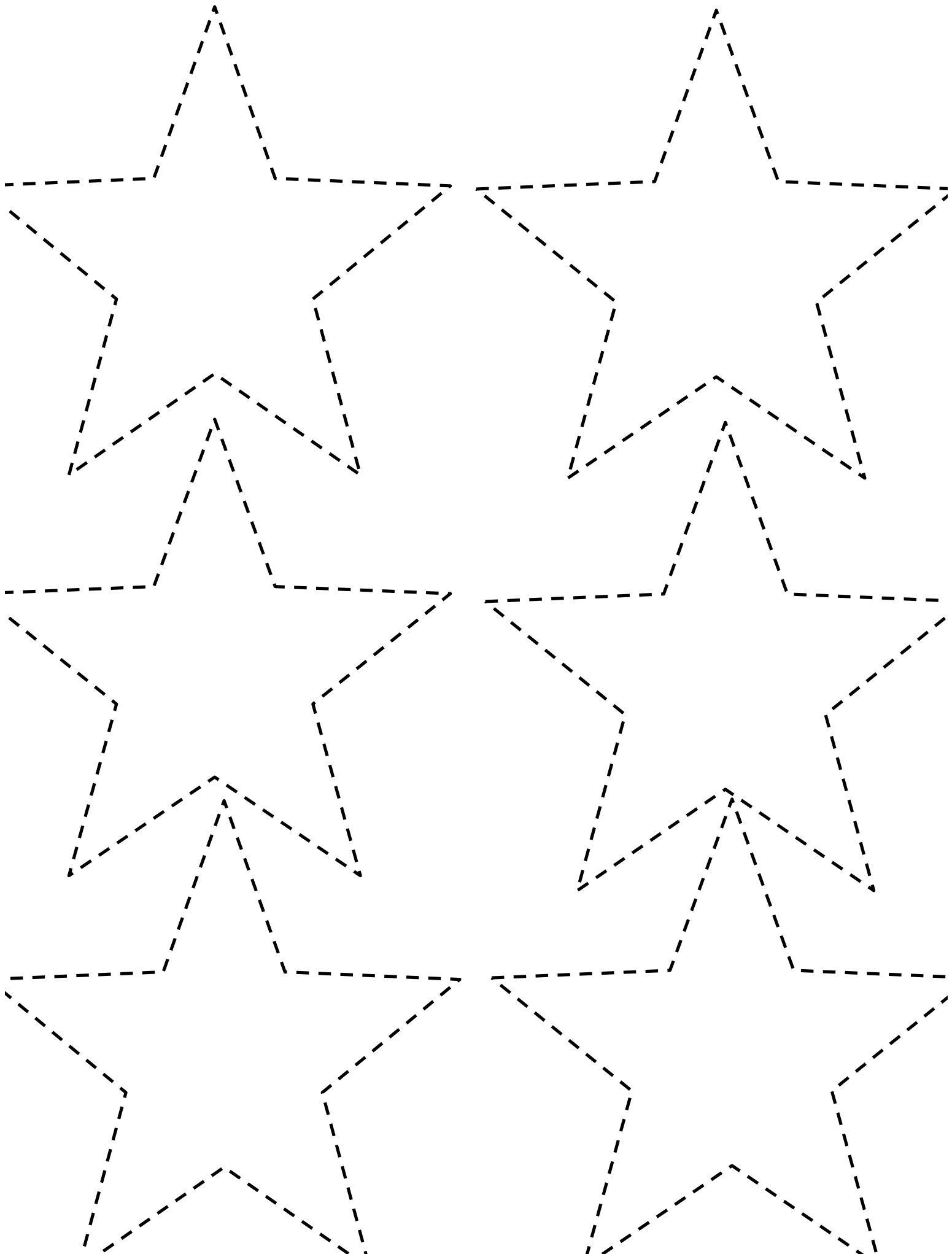
Lead Boy and Lead Girl gather all of the children in the playground and say goodbye. “Alright kids,” begins Lead Boy. “Today we have taught you a little bit about how you can protect yourselves from the chemical lead. This is not to scare you but to give you advice on how to stay healthy.”

“Yes, lead is not something to be afraid of but something to be aware of.” Lead Girl continues. “Lead can be found everywhere, even in the air and in water. Small amounts of lead are okay in your body, but by practicing safety measures like not chipping paint, not putting toys in your mouth, always washing your hands, eating healthy, and exercising, you will be safe from getting sick.” says Lead Girl

The kids cheer, and Lead Boy and Lead Girl are happy that the kids had fun while learning about lead. The superheroes fly away as the kids’ wave them goodbye. The children then went on to live a healthier lifestyle, day by day.







# Soi Dao Game Question Sheet

1. What is lead?

Lead is a **chemical**, which may be present in our environment at any time. **It is highly toxic.**

2. Is lead bad for your body? How?

Sometimes **lead can make you sick**. It goes into your blood and then might stop you from growing up big and strong.

3. How can lead get into the body?

You can **eat** it (ex. eating paint chips, eating dirty food that has fallen from the floor, etc).

4. How can lead get into your body? (name another way!)

You can **breathe** it in (ex. Breathing polluted air).

5. How can lead get into your body? (name another way!)

If you have a cut, and get the cut dirty, lead may be absorbed directly into your blood.

6. How does lead affect the body?

**Lead can make you sick**. Lead exposure may show no symptoms, but it can result in brain damage and developmental disabilities.

7. How does lead get into the environment?

**Industrial processes**, such as **mining and manufacturing** introduce lead into the air, water, and soil.

**Automobile emissions** may also contribute to lead in the air.

**Lead paint** may be used on **houses, playgrounds, or toys**.

8. Name one place where lead can be found.

Paint

9. Name one place where lead can be found.

Painted Toys

10. Name one place where lead can be found.

Tap Water

11. Name one place where lead can be found.

Soil

12. Name one place where lead can be found.

Smoke from Vehicles

13. Can lead be found in food dyes (True or False)?

True!



14. Exposure to lead might not show any symptoms. True or false?

True!

15. What would you do if you were exposed to lead?

Talk to an adult            Get a lead test  
Go to the doctor            Wash hands more

16. What can you do to prevent lead exposure?

Washing Hands Often / Avoid Chipping Paint

17. What can you do to prevent lead exposure?

Don't Play in Dirt in Playground

18. What can you do to prevent lead exposure?

Good Diet, High Calcium

19. What can you do to prevent lead exposure?

Do not drink tap water

20. Why do you have to wash your hands before eating?

You must wash your hands before eating **to remove any dirt or dust** that could be on them. You do not want to accidentally eat anything harmful!



Student Survey (After Lesson)

Name:

Grade:

1. Can chemicals in the environment be unhealthy?
  - a. Yes
  - b. No
  
2. Do you understand what lead is?
  - a. Yes
  - b. No
  
3. Where can lead be found? (You can circle multiple answers)
  - a. Painted Toys/Playgrounds
  - b. Drinking Tap Water
  - c. Dirt and Air
  - d. Food Dyes

4. Does lead make you sick?
  - a. Yes
  - b. No
  
5. What can you do to be safe and avoid lead? (You can circle multiple answers)
  - a. Wash your hands
  - b. No toys in mouth
  - c. Drink Milk
  - d. Eat a healthy diet which includes Calcium, Iron, and Vitamin C
  
6. After this lesson, do you now feel that you can protect yourself from lead exposure?
  - a. Yes
  - b. No
  
7. Did you have fun during this program about lead?
  - a. Yes
  - b. No

Stickers





Dear Parent/Caregiver,

Today your child learned about lead exposure and its prevention in class. The class listened to a short story, which stressed the importance of hand washing, playing in clean areas, and maintaining a healthy diet.

Please discuss the story with your child. Your child may be too young to understand the effects of lead exposure but as his/her caregiver, you should know that lead exposure could harm a child. Lead poisoned children may have difficulty concentrating, may be slower learners, or even hyperactive. Physical symptoms may not be obvious.

The pamphlet I am sending home with your child today contains important information on lead exposure along with numbers to call for more information.

Please take time to read it over.

Thank you for your help as we all work together to prevent childhood lead poisoning.

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*See Pamphlet Attached*



### Lesson Plan (Grades 1-3)

Below you will find our complete lesson plan designated for Grades 4-6. This is all-inclusive and can also be found as a digital copy in the Thai language on our website:

<http://sites.google.com/site/leadfreecommunity/home>



# Raising Awareness about Childhood Lead Exposure in Schools in Thailand



*Lesson Plan  
Grades 4-5*



# Welcome, and thank you!

*We are very excited that you have chosen to participate in our educational program on raising awareness about childhood lead exposure in schools in Thailand. We have worked very hard on this program and feel that it will greatly help educate your students on the basics of the chemical lead and what steps they can take to live a healthier lifestyle. We have also included pamphlets for the parents, teachers, and administration of the school community to further the education of the student's support system. This is all in an effort to raise awareness of lead concerns and exemplify healthy practices to your students, the future of Thailand.*

*In the early stages of designing this program, we interviewed teachers in Thailand to get a better understanding of how the students would learn best, what activities they would find interesting and enjoyable, and what lesson plans teachers would prefer. We feel that we have created the most effective program using suggestions by teachers in Thailand to best educate the students about various lead sources and prevention tips.*

*Also, during the creation of this program, the children's well being was of upmost concern. We did not want the material to be so frightening that the students did not feel comfortable playing on playgrounds or with various toys. Our main goal is to raise awareness among the students in a fun, informative way so that they feel that chemical lead is not something to be afraid of, but rather something to be aware of.*

*With your help, we can teach these young children basic information on lead poisoning and various ways they can protect themselves. Again, thank you for participating in this program, and we hope that it may guide your students in the positive direction to a lead free community.*

**- The Lead Education Team**



# Program Overview

<b>Pre-Student Surveys .....</b>	<b>132</b>
<b>Lecture .....</b>	<b>132</b>
<b>Jeopardy Quiz Game.....</b>	<b>133</b>
<b>Student Post-Survey .....</b>	<b>133</b>
<b>Lead Boy and Lead Girl Stickers/Parent Letter and Pamphlet.....</b>	<b>134</b>



# Pre-Student Surveys

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*The first portion of the educational program is the Student Pre-Survey (See the Appendix for the Student Pre-Survey Template). The purpose of the pre-survey is solely for the students to answer questions about the chemical lead to the best of their ability and to compare it's results with the Student Post-Survey at the end of the program. This will determine whether the students retained their new knowledge about lead exposure.*

Pass the pre-survey out to each student and administer to students at teacher discretion.

Be sure that each student writes his or her name on the survey.

Once the students have completed the survey, collect and store for later use.

## Lecture

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*The next portion of the program is the Lecture (See the Appendix for the Lecture Notes). This Lecture is a fun and informative presentation for the students that teach them the basics of the chemical lead, the affects of lead on the body, and various prevention strategies the students may take to stay healthy. This lecture will ideally inform the students, while keeping them engaged.*

*The Lecture is in the form of a PowerPoint, with Lecture Notes for the teacher found in the Appendix. Follow the PowerPoint while noting every point of information on the Lecture Notes. Go to the next slide on the PowerPoint at the "Next Slide" cues in the Lecture Notes.*

Gather the students and present the Lecture in a fun and interesting way using the PowerPoint and the Lecture Notes.

If your school does not have projecting capabilities, lecture the students on the material provided in the Lecture Notes.



# Jeopardy Quiz Game

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*The next portion of the program is the Jeopardy Quiz Game (See the Appendix for the Jeopardy Quiz Questions/Answers and Jeopardy Quiz Template). The purpose of the Jeopardy Quiz Game is to quiz the children on their new knowledge of lead poisoning. The Jeopardy Quiz Game is in the form of a PowerPoint Presentation. Follow the Jeopardy Quiz Game Instructions below.*

If your school does not have projecting capabilities, draw the Jeopardy Quiz Template on a board, use the Jeopardy Quiz Questions/Answers sheet, and follow the Jeopardy Quiz Game Instructions below.

## Jeopardy Quiz Game Instructions

7. Set the students into 6 groups, numbered 1-6, and choose a team leader.
8. The team leader from group 1 chooses a question from preferred category and score.
9. If the group can answer the question correctly, sum the score of the question to the team's total score.
10. BUT, if that group cannot determine the answer, the question is open to the other teams. The other teams may talk amongst themselves, determine the answer, and raise their hands. The first group to raise their hands may answer aloud. If correct, sum the score of the question to the team's total score.
11. Repeat steps 2-4 in order from team 1-6 (there are 18 questions).
12. At the end of the game, the team who has the highest score receives prizes for all members. (We recommend pencils, key chains, dolls, or candy)

# Student Post-Survey

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*The next portion of the program is the Student Post-Survey (See the Appendix for the Student Post-Survey Template). The purpose of the post-survey is solely for the students to answer questions about what they learned throughout the program and compare it's results with the Student Pre-Survey given at the beginning of the program. This will determine whether the students retained their new knowledge about lead exposure.*

Pass the post-survey out to each student and administer to students at teacher discretion. Be sure that each student writes his or her name on the survey. Once the students have completed the survey, collect and compare with Student Pre-Survey results.



# Lead Boy and Lead Girl Stickers/Parent Letter and Pamphlet

*The final portion of the educational program is to distribute the Lead Boy and Lead Girl Stickers (See the Appendix for the Lead Boy and Lead Girl Sticker Templates) and the Parent Letter and Pamphlet (See the Appendix for the Parent Letter and Pamphlet). The purpose of the stickers is to remind the students of what they learned during the program. The purpose of the Parent Letter and Pamphlet is to inform the student's parents about what their children have just learned and how they can continue to encourage healthy habits.*

Distribute one sticker to each student.

Distribute one Parent Letter and one Parent Pamphlet to each student. We also recommend requiring a signature from the parents to ensure that the student provided this information to their parent. This is to the school administration's discretion.

## Thank you!

*You have successfully completed the **Raising Awareness about Childhood Lead Exposure in Schools in Thailand** educational program. Thank you for your time and we hope that this lesson was simple to understand and enjoyable to teach. We look forward to any feedback you may provide on your experience during the lesson.*

*Be sure to refer to our website: <http://sites.google.com/site/leadfreecommunity> and contact us by emailing [bkk13lead@gmail.com](mailto:bkk13lead@gmail.com)*



# Appendix

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Below you will find all of the materials necessary to complete this lesson plan. All electronic material (including all PowerPoints and other informational documents) may be found at our website <http://sites.google.com/site/leadfreecommunity> within the “Teachers” tab.



Student Survey (Before Lesson)

Name:

Grade:

7. Can chemicals in the environment be unhealthy?

- a. Yes
- b. No

8. Have you heard of lead

- a. Yes
- b. No

9. Where can lead be found?  
(You can circle multiple answers)

- a. Painted Toys and Playgrounds
- b. Drinking Tap Water
- c. Dirt and Air
- d. Food Dyes

10. Does lead make you sick?

- a. Yes
- b. No

11. What can you do to be safe and avoid lead?  
(You can circle multiple answers)

- a. Wash your hands
- b. No toys in mouth/Avoid Chipping Paint
- c. Drink Milk
- d. Eat a healthy diet which includes Calcium, Iron, and Vitamin C

12. Do you want to learn more about lead?

- a. Yes
- b. No





# Lecture Notes

*This presentation is meant to be interactive for the students. Since learning about lead safety is likely to be a new subject for them, let the students guess what they think before introducing all of the material.*

1. Lead-Free Community
  - a. Staying Healthy and Fighting lead exposure  
**NEXT SLIDE**
  
2. What is a Chemical? Guess!
  - a. *Have the students guess what they think a chemical is*  
**NEXT SLIDE**
  
3. A chemical is a substance in the form of solid, liquid or gas that is toxic and can cause harm to your body. Some chemicals can cause corrosion, irritation, allergies and cancer.  
**NEXT SLIDE**
  
4. What is Lead?
  - a. *Let the students guess what lead is.*
  - b. Lead is a metallic substance, or chemical, found in Earth's crust that is also introduced into our environment by human beings.  
**NEXT SLIDE**
  
5. How does lead get in the environment?
  - a. Emissions from cars
  - b. Industrial processes
  - c. Pollution of water and air
  - d. Lead dust *from chipping lead paint*  
**NEXT SLIDE**
  
6. Where is lead found? Guess!
  - a. *Have the students guess before you give them the answers*
  - b. Air
  - c. Tap Water
  - d. Soil
  - e. Paint  
**NEXT SLIDE**
  
7. How can lead get in the body?
  - a. Breathing it in
  - b. Eating food (or paint) containing lead
  - c. Example: Putting toys in your mouth
  - d. Drinking liquids (tap water) containing lead
  - e. Through a cut in your body



**NEXT SLIDE**

8. How lead can affect the body after short-term exposure
  - a. Dizziness
  - b. Upset stomach
  - c. Depression
  - d. Inability to focus and loss of hand-eye coordination

**NEXT SLIDE**

9. How lead can affect the body after long-term exposure
  - a. Learning Disabilities/Lowered IQ
  - b. Brain Damage
  - c. Autism
  - d. Anemia
  - e. Blindness
  - f. Deafness
  - g. Hypertension
  - h. Cardiovascular Disease/Dysfunction

**NEXT SLIDE**

10. However, you can have too much lead in your body and show no symptoms!
  - a. *This will help stress the importance of the students maintaining healthy habits even if they don't think they have shown any of the symptoms.*

**NEXT SLIDE**

11. How to prevent lead exposure
  - a. Wash hands frequently
    - i. Before every meal
  - b. Avoid peeling paint
  - c. Avoid broken plaster and holes in walls
  - d. Eat healthy foods for at least 3 meals a day
    - i. Calcium – helps fill the holes in your bones and keeps your bones strong so lead does not deposit in the holes. Examples are milk, egg yolk, black sesame, and Chinese broccoli
    - ii. Vitamin C - helps prevent the absorption of lead into the bloodstream. Examples are orange, tomato, grapes, and watermelon
    - iii. Iron fights lead once it is in the body. Examples are red meat, raisins, prunes, and liver

**NEXT SLIDE**

12. How to stop the effects of lead in your body
  - a. Don't drink tap water- drink plenty of bottled water
  - b. Have a healthy diet, including calcium, iron, and vitamin C
  - c. Frequent check ups

**NEXT SLIDE**

13. Any questions?



## Jeopardy Questions/Answers

*The questions, categories, and point values are listed below. If your school does not have projecting capabilities, draw the Jeopardy Board Template on a board and use these Questions and Answers throughout the game. The category is highlighted next to the question. The point value follows the category.*

13. What is lead? **SOURCES 100**

Lead is a **chemical**, which may be present in our environment at any time. **It is highly toxic.**

14. How can lead get into the body? **SOURCES 200**

You can **eat** it (ex. eating paint chips, eating dirty food that has fallen from the floor, etc.).

15. Where lead can be found? **SOURCES 300**

Paint on walls, playgrounds, etc.                      Tap Water  
Dirt    Air

16. Why is lead used in industrial processes? **SOURCES 400**

Lead is **cheap** and it can be **found naturally** in the environment.

17. How does lead get into the environment? **SOURCES 500**

**Industrial processes**, such as **mining and manufacturing** introduce lead into the air, water, and soil.

**Automobile emissions** may also contribute to lead in the air.

**Lead paint** may be used on **houses, playgrounds, or toys.**

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18. Exposure to lead might not show any symptoms. True or false? **EFFECTS 100**

True!

19. Can lead exposure cause death? **EFFECTS 200**

**Yes.** If the amount of lead in your body is too high, it can hurt your brain.

20. How does lead affect the body? **EFFECTS 300**

**Lead can make you sick.** Lead exposure may show no symptoms, but it can result in brain damage and developmental disabilities.

21. What are the short-term effects of lead to the body? **EFFECTS 400**

Lead exposure may cause dizziness, headache, upset stomach, depression, inability to focus, and loss of hand-eye coordination.



22. What are the long-term effects of lead to the body? **EFFECTS 500**

Extended lead exposure may cause brain damage, learning disabilities/lowered IQ, autism, anemia, blindness, deafness, encephalopathy, hypertension, and cardiovascular disease/dysfunction.

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23. If you feel you are exposed to lead poisoning, should you go to the doctor? **SAFETY 100**

**Yes**

24. What can you do to prevent lead exposure? **SAFETY 200**

Wash hands frequently      Don't eat paint chips  
Don't play in dirty areas      Drink only bottled water  
Eat plenty of Iron, Calcium, and Vitamin C  
Let tap water run for 30 seconds before using it

25. Why do you have to wash your hands before eating? **SAFETY 300**

You must wash your hands before eating **to remove any dirt or dust** that could be on them. You do not want to accidentally eat anything harmful!

26. Why are children more susceptible to lead than adults? **SAFETY 400**

**Children are still growing and developing**, so they are more susceptible to lead poisoning because they have not yet developed bodily defenses to combat lead exposure.

27. Healthy diets help stop lead absorption in the body system. Which nutrients should these diets contain? **SAFETY 500**

Iron, Calcium, and Vitamin C



# Jeopardy Board Template

**“JEOPARDY”**  
เกมส่กทดสอบสมองประลองปัญญา

สาเหตุ	ผลกระทบ	วิธีป้องกัน
<u>100</u>	<u>100</u>	<u>100</u>
<u>200</u>	<u>200</u>	<u>200</u>
<u>300</u>	<u>300</u>	<u>300</u>
<u>400</u>	<u>400</u>	<u>400</u>
<u>500</u>	<u>500</u>	<u>500</u>



## Student Survey (After Lesson)

Name:

Grade:

1. Can chemicals in the environment be unhealthy?
  - a. Yes
  - b. No
  
2. Do you understand more about lead because of this lesson?
  - a. Yes
  - b. No
  
3. Where can lead be found? (You can circle multiple answers)
  - a. Painted Toys and Playgrounds
  - b. Drinking Tap Water
  - c. Dirt and Air
  - d. Food Dyes
  
4. Does lead make you sick?
  - a. Yes
  - b. No
  
5. What can you do to be safe and avoid lead? (You can circle multiple answers)
  - a. Wash your hands
  - b. No toys in mouth/Avoid Chipping Paint
  - c. Drink Milk
  - d. Eat a healthy diet which includes Calcium, Iron, and Vitamin C
  
6. After this lesson, do you now feel that you can protect yourself from lead exposure?
  - a. Yes
  - b. No
  
7. Did you have fun during this program about lead?
  - a. Yes
  - b. No



Stickers





Dear Parent/Caregiver,

Today your child learned about lead exposure and its prevention in class. The class listened to a short story, which stressed the importance of hand washing, playing in clean areas, and maintaining a healthy diet.

Please discuss the story with your child. Your child may be too young to understand the effects of lead exposure but as his/her caregiver, you should know that lead exposure could harm a child. Lead poisoned children may have difficulty concentrating, may be slower learners, or even hyperactive. Physical symptoms may not be obvious.

The pamphlet I am sending home with your child today contains important information on lead exposure along with numbers to call for more information.

Please take time to read it over.

Thank you for your help as we all work together to prevent childhood lead poisoning.

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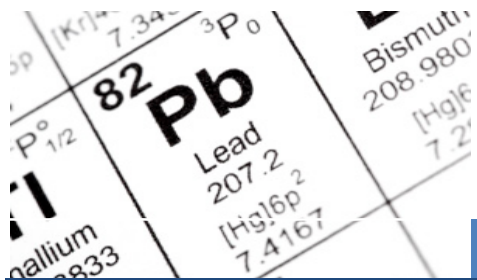


*See Attached Pamphlet*



## Informational Pamphlet

Next you will view our Informational Pamphlet about the chemical lead, where it comes from, how it affects the body, and what you can do to prevent yourself.



## What is Lead? Where is it found?

**Lead is a metal often introduced into the environment around us through industrial processes.**

Lead is often introduced to the environment as a by-product of burning fossil fuels, mining, and manufacturing (NCDOL). According to the NIEHS (National Institute of Environmental Health Sciences), "the most common sources of lead exposure are lead-based paint in older homes, contaminated soil, household dust, drinking water, lead crystal, and lead-glazed pottery." Chipping lead paint and emissions from vehicles and factories can get lead particles into the air as well. Lead's low cost contributes to its use in many products. **Therefore, lead can be found in a wide variety of places because it occurs naturally and is spread to air, water, and soil as a result of human activity.**

## For more information...

<https://sites.google.com/site/leadfreecommunity/>

Please visit these websites to learn more about lead exposure!

*Pollution Control Department*  
[www.pcd.go.th](http://www.pcd.go.th)

*Ministry of Public Health*  
[www.dmhc.moph.go.th](http://www.dmhc.moph.go.th)

### References

- Lead Poisoning in Children. 2012. Centers for Disease Control and Prevention. Gateway to Health Communication & Social Marketing Practice. 16 October 2012.  
<http://www.cdc.gov/healthcommunication/ToolsTemplates/EntertainmentEd/Tips/LeadPoisoningChildren.html>
- N.C. Department of Labor Occupational Safety and Health Division (n.d.). Lead Fact Sheet. Retrieved from [www.nclabor.com/pubs.htm](http://www.nclabor.com/pubs.htm)
- World Health Organization, (2008). *Lead contamination of ground water, Rayong*. Retrieved from World Health Organization for South-East Asia website:  
[http://www.searo.who.int/en/Section23/Section1318/Section1797\\_7718.htm](http://www.searo.who.int/en/Section23/Section1318/Section1797_7718.htm)

**Thamassat University**

School of Global Studies  
Academic Services Center Building  
Rangsit, Pathum Thani, Thailand 12121

# Schools: A Lead

*Lead Exposure:*

*Protecting yourself*



# How Lead Affects the Body

*Lead can be ingested into the body by consuming food, chipped paint, drinking water that contains lead, or breathing in lead dust.*

**Health effects caused by short-term exposure include:**

dizziness, depression, inability to focus, loss of hand-eye coordination, upset stomach.

**Health effects caused by long-term exposure include:** anemia, autism, blindness, cardiovascular disease or dysfunction, deafness, encephalopathy, hypertension, learning and developmental disabilities, lowered IQ and sometimes death.

*Lead exposure does not always exhibit symptoms.*



## What You Can Do To Protect Yourself

-Avoid Lead Exposure by Maintaining Healthy Habits

### Healthy Habits for You

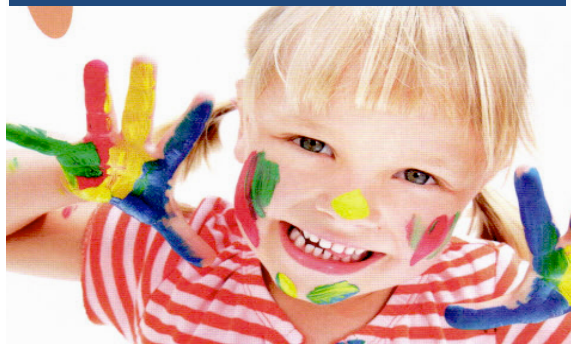
- Clean dusty surfaces with a damp cloth to minimize lead dust
- Avoid patches of exposed dirt
- Don't go near peeling paint, and hire a trained professional to remove paint or repaint walls
- Allow the tap to run for at least 30 seconds before using the water
- Wash your hands before eating
- If possible, drink only bottled water- don't drink tap water!
- Maintain a diet rich in Iron, Calcium and Vitamin C
- Ask your doctor about a blood lead level test

### Healthy Habits for the Children

- Encourage children to wash their hands before eating
- Do not allow children to play in the dirt, move them to a grassy location
- Prevent children from eating paint chips, dirt, or dust

### Treatments

If you discover that you have an elevated level of lead in your system, speak with your doctor immediately. Treatment is possible. In the most severe cases, chelation therapy is necessary to remove heavy metals from the body. Remember that with healthy habits, lead exposure is easy to avoid.



## Healthy Habits Poster

Our Healthy Habits Poster can be viewed below. This poster was gifted to the two schools that we implemented our program to display and remind the students about what they learned and how to stay safe from lead.



Website: Lead Free Community

Below you will find screenshots of our original website, Lead Free Community. You may view the entire website at

<http://sites.google.com/site/leadfreecommunity/home>

**ชุมชนปลอดสารตะกั่ว**

Home สำหรับเด็กนักเรียน สำหรับผู้ปกครอง สำหรับคุณครู สำหรับผู้บริหารของโรงเรียน ติดต่อมีประโยชน์

### ชุมชนปลอดสารตะกั่ว

**ยินดีต้อนรับเข้าสู่เว็บไซต์ของเรา!**

**เป้าหมายของเรา:** เว็บไซต์ชุมชนปลอดสารตะกั่วนี้ ถูกสร้างขึ้นเพื่อให้ความรู้กับผู้เข้าชม เกี่ยวกับที่มาของสารตะกั่ว อันตรายจากสารตะกั่ว และวิธีป้องกันตนเองจากสารตะกั่ว ข้อมูลที่เป็นประโยชน์ถูกทำเป็นแบบเรียนโปสเตอร์ และ เกมส์ สื่อการเรียนการสอนเหล่านี้มีจุดประสงค์เพื่อที่จะลดความเสี่ยงซึ่งเกิดจากการปนเปื้อนของสารตะกั่วในโรงเรียน

ในเว็บไซต่นี้ มีแบบแผนการเรียนการสอน คำอธิบายเกี่ยวกับการจัดกิจกรรม เพื่อให้ความรู้นี้ แผ่นพับสำหรับผู้ปกครอง คุณครู และผู้บริหาร รูปแบบของสติกเกอร์ และ โปสเตอร์ ซึ่งผู้เข้าชมเว็บไซต์สามารถดาวน์โหลดได้ในแถบต่างๆ ด้านบน

**พวกเราคือใคร:** พวกเราคือนิสิต นักศึกษาจากสถาบัน Worcester Polytechnic Institute ประเทศสหรัฐอเมริกา และ จากคณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย โดยมีผู้สนับสนุนอย่างเป็นทางการคือ สถาบันโลกาภิวัตน์ศึกษา มหาวิทยาลัย ธรรมศาสตร์

**ติดต่อเรา:**  
อีเมล : [bkk13lead@gmail.com](mailto:bkk13lead@gmail.com)

**โรงเรียนที่เข้าร่วมกิจกรรม**

โรงเรียนที่ 1 : โรงเรียนวัดปทุมวนารามฯ กรุงเทพมหานคร (มกราคม 2556)  
โรงเรียนที่ 2 : โรงเรียนบ้านเข้าห้วยมะหาด จังหวัดระยอง (กุมภาพันธ์ 2556)

**ชุมชนปลอดสารตะกั่ว**

Home สำหรับเด็กนักเรียน สำหรับผู้ปกครอง สำหรับคุณครู สำหรับผู้บริหารของโรงเรียน ติดต่อมีประโยชน์

### สำหรับคุณครู

สำหรับคุณครู เราได้จัดทำแผ่นพับซึ่งมีเนื้อหาเกี่ยวกับของของผู้ปกครอง และแบบแผนการเรียนการสอนซึ่งประกอบด้วย ข้อมูลการสอน และวิธีการจัดกิจกรรม เกมส์ และ การวัดผลของเด็กนักเรียน ซึ่งคุณครูสามารถอ่านตามและทำความเข้าใจกับเนื้อหาได้ง่าย แบบแผนการเรียนถูกแบ่งออกเป็นสองระดับขึ้นเช่นกัน คือ ประถมต้น และ ประถมปลาย

**นิทานสั้นสำหรับเด็กนักเรียนชั้นประถมต้น (1-3)**

เพื่อนำเสนอ powerpoint สำหรับประถมปลาย .pptx (6963k)	Bangkok Project Group, Feb 19, 2013, 6:41 PM	v.1	↓
แบบแผนการเรียนการสอนสำหรับประถมชั้นต้น LESSON PLAN_GRADES 1-3 thai final.pdf (1 Bangkok Project Group, Feb 6, 2013, 8:17 PM)	Bangkok Project Group, Feb 6, 2013, 8:17 PM	v.1	↓
แบบแผนการเรียนการสอน สำหรับชั้นประถมปลาย. Lesson Plan Grades 4-5 Thai Final ... Bangkok Project Group, Feb 6, 2013, 8:15 PM	Bangkok Project Group, Feb 6, 2013, 8:15 PM	v.1	↓
แผ่นพับสำหรับคุณครู ผู้ปกครองและ ผู้บริหาร.pdf (578k)	Bangkok Project Group, Feb 7, 2013, 7:22 PM	v.1	↓

**WPI** **BSAC**